

YORK COUNTY SANITARY SEWER STANDARDS AND SPECIFICATIONS

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SECTION I DESIGN PARAMETERS AND CRITERIA

A. General Requirements:

The following "Sanitary Sewer Standards and Specifications" shall be followed for the design, construction, inspection, testing and acceptance of all sanitary sewer facilities installed in York County. The requirements specified hereinafter are considered to be minimal requirements.

The governing body of York County may permit the extension of the public sewer system by a developer. All such extensions shall be at the request of the developer and shall be made pursuant to a Public Sewer Extension Agreement (PSEA) between the developer and the County executed by the County Administrator on behalf of the County, and approved as to form by the County Attorney. The PSEA shall include terms providing for the amount of all fees to be paid to the County and providing that all required connection fees shall be paid prior to any connection to the existing system. The PSEA shall set forth any cost sharing and provide that, upon completion and approval of the construction of such facilities, including satisfactory completion of all warranty and guarantee periods, they shall become the property of the County. Such PSEA shall be executed by all parties prior to the issuance of a Certificate to Construct (§18.1-53 York County Code).

The applicant/developer shall accept responsibility for the costs of all Virginia Department of Transportation (VDOT), Virginia Department of Health (VDH), and/or Virginia Department of Environmental Quality (DEQ), inspections and/or tests of roadways, drainage structures or other facilities requiring VDOT, VDH, or DEQ review and approval.

Design of all sewage facilities that are to be dedicated to the County shall be performed by a Professional Engineer or Professional Land Surveyor with Part A and B license certified by the Commonwealth of Virginia. Pumping facilities require Professional Engineer certification. All designs shall be in accordance with the Virginia Sewerage Regulations.

Vertical and horizontal survey datum control shall be based upon, and referenced to, the **Primary Geodetic Control Network of York County, Virginia**. Ground measurements shall be furnished in U.S. Survey Feet and reference the Virginia Coordinate System of 1983, South Zone. A minimum of one permanent benchmark that meets the requirements of the **Subdivision Ordinance of York County, Virginia** shall be established for each development project.

Sanitary sewers are designed for the collection and transmission of wastewater. Downspouts; commercial garbage disposals; car washes without recycled water;

foundation drains; yard drains; area drains; basement drains; residential, industrial and commercial cooling water; hazardous waste materials; and sump discharges for other than sanitary wastes shall not be connected to the facilities of the County nor into any sewer leading into any facilities of the County. Other connections are to be approved on a case-by-case basis.

Provisions shall be made for logical future extensions at proposed or existing street connections, and at other locations as required by the County. Future extensions shall be provided for by a stubbed section of pipe. This pipe shall be properly plugged, blocked, and pressure tested along with the rest of the sewer system.

The safety and protection of public and private water supplies is of paramount importance. There shall be no connection between any public or private potable water supply system and any sewer or appurtenance thereto which would permit the passage of any sewage or polluted water into the potable water supply.

B. Definitions

Unless the context specifically indicates otherwise, the meaning of terms used herein shall be as follows:

AASHTO: American Association of State Highway and Transportation Officials.

Abut: touching, adjoining, or bordering on.

Acceptance: means approval and subsequent ownership including satisfactory completion of all warranty and guarantee periods by the York County Board of Supervisors or their designated representative.

ANSI: American National Standards Institute

Applicant: the owner of the property to be served, or his duly authorized representative who applies to the County for sewer service.

Approved: approved by the County Administrator or his designated representative.

Appurtenance: any accessory object or component connected to a public sewer.

As-built Drawing: record drawings of the completed facilities showing actual constructed elevations, dimensions and locations.

ASTM: American Society for Testing and Materials.

Average Daily Flow - ADF: the average flow rate during a typical 24 hour period of normal usage measured over a 30 day period.

AWWA: American Water Works Association.

Buffer: an area, structure or landscaping used to separate one use from another or to shield or block noise, light, glare, pollutants or other nuisances.

Building: any structure having a roof supported by columns or walls, including modular and pre-fabricated buildings, which is used for the shelter, housing, or enclosure of persons, animals, or tangible property and, unless specifically exempted, constructed in accordance with all applicable provisions of the Virginia Uniform Statewide Building Code.

Building sewer: a sewer system conveying wastewater from the improvements on the premises of a user to the facilities of the County, to private sewage systems, to individual sewage disposal systems, or to other points of disposal.

Certificate of Occupancy: a document issued by the Department of Environmental and Development Services allowing the occupancy or use of a building and certifying that the structure and/or site has been constructed to be used in accordance with all applicable plans, codes and ordinances.

Cleanout assembly: includes the riser pipe, fittings, cleanout cap and cast iron cover which is located near the property or easement line for access to the lateral line where connection is made to the building sewer.

Code: The Virginia Uniform Statewide Building Code, National Fire Protection Association, Virginia Safety and Health Codes, Commonwealth of Virginia and the County of York.

Connection fee: an initial charge levied to defray the costs associated with providing public sewer.

Construction: any placement or installation of sewer facilities or equipment including preparation and/or restoration work for such installation.

Contractor: any person performing work (other than the County) on facilities of the County or facilities proposed to be dedicated to the County.

County: York County, Virginia, or any of the established Sanitary Districts in York County.

County Administrator: shall mean the County Administrator of York County, Virginia, as appointed by the York County Board of Supervisors. References to the County Administrator as used in these standards and specifications shall be deemed to include the Administrator or his designated agent.

Customer: the party who has applied for and receives continuing sewer service by the County and who is responsible for payment of such services.

Department: the Department of Environmental and Development Services.

DEQ: the Commonwealth of Virginia, Department of Environmental Quality.

Developer: any person having a legal interest in real property which may now or in the future be served by the facilities of the County and who is or may be responsible for the design and/or construction of such facilities.

Development: any building or subdivision activity which is required to have either site plan or subdivision approval of the County before it is commenced.

Director: the Director of Environmental and Development Services for the County.

Domestic Wastes: the wastes produced from non-commercial or non-industrial activities, and which result from normal human living processes, which are of substantially similar origin and strength to those typically produced in households, including wastes from sanitary conveniences.

Dwelling unit: a single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation.

Easement: a grant by a property owner recorded with the Clerk of the Circuit Court for the use of his land by another party for a specific purpose.

Elevated Sand Mound: an above grade mound designed by an engineer currently licensed to practice in the Commonwealth of Virginia, to treat septic tank effluent prior to its percolation in a soil absorption area.

Engineer: the Environmental and Development Services representative whose duty is to ensure that work done for the County complies with these specifications. The engineer may be an employee of the County or an engineer appointed to represent the County in such matters.

Facilities of the County: any sewer pipe, manhole, pumping station, force main, or other appurtenance of the wastewater collection system or treatment works, whether located within or without the boundaries of the County, which have been, are, or are intended to be installed, operated or maintained by the County or in the installation, operation or maintenance of which the County has participated, is participating, or intends to participate financially.

Force main: a sewer line that carries sewage under positive pressure.

Future use capacity: capacity for the future in system facilities; capacity not needed at time of design and construction to accommodate existing needs; or capacity which provides for the future development of property and for community growth.

Governing body: the Board of Supervisors of York County which serves as the governing body for both the County and the sanitary districts of the County.

Gravity sewer: a collection system where gravity is used to transport wastewater from the customer's premises to a centralized collection or pumping facility.

Grease Trap: a structure designed to facilitate the capture of grease from the effluent stream.

Grinder pump: a compact lift or pump station with pump(s), storage capacity and appurtenant piping, valves and other mechanical and electrical equipment which grinds or reduces the particle size of wastewater solids to yield a sewage slurry and which conveys the waste from its source to a gravity sanitary sewage collection system or a sewage force main.

Health Department: the local office of the Virginia Department of Health.

HRSD: the Hampton Roads Sanitation District which is the regional agency that provides regional transmission and treatment facilities for wastewater.

Incremental capacity: the additional capacity required in system facilities to accommodate a specific development.

Industrial wastes: liquid and liquid carried wastes resulting from industrial, manufacturing, trade or business processes, including industrial cooling water and unpolluted trade or process waste, as distinguished from domestic wastes.

Industry/Industrial user: any place of business, endeavor, arts, trade, or commerce, whether public, government, private, commercial or charitable, which uses water in a product, process, or in any manner that generates wastewater which is discharged to a publicly operated treatment works (POTW).

Infiltration: water entering a wastewater system from the ground, through such means as defective pipes, pipe joints, connections, or manhole seepage.

Inflow: water discharged into a wastewater system from such sources as roof leaders, cellar drains, yard drains, area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections, storm sewers and

combined sewers, catch basins, storm waters, surface runoff, street wash waters, or drainage.

Inspector: a person authorized by the County to inspect the construction of wastewater conveyance and transporting facilities that are to be dedicated to the County for future maintenance and operation.

Lateral line: a sewer line that discharges into a main or sub-main sewer line and has no other common sewer line tributary to it.

Local facilities: all sewer facilities serving only one development; any lateral line to which a building sewer connection is made; all gravity sewers eight inches or less in diameter; and sewer facilities whether on-site or off-site, necessary to make the facilities of the County accessible to the premises.

Lot: any tract of land described in a recorded deed or on a subdivision plat of record, and which possesses or is in the process of being assigned a number for tax assessment identification purposes. For purposes of development a lot may consist of an individual lot of record, or combinations of adjacent recorded lots and/or portions of lots of the same ownership.

Low Pressure Distribution: the conveyance of effluent through pressure percolation lines at full flow conditions into the absorption area with the prime motive force being a pump.

Main line: a sewer pipeline that receives, or will receive, flow from one or more sub-mains.

Manual and Manual of Practice: the Virginia Department of Environmental Quality/State Health Department Manual of Practice for Sewerage Systems.

Meters: an instrument for measuring the amount or rate of flow.

Minimum Daily Flow - MDF: the minimum flow rate determined by use of the appropriate factor times the average daily flow (generally $MDF = 0.5ADF$), or as measured directly over a 30 day period for existing developed areas.

Off-site extension: an extension of a sewer line from existing local or system facilities of the County to the property boundary of the developer or applicant in a manner and location approved by the County.

Ordinance: the municipal regulation authorizing passage of requirements for sewage disposal in York County.

Owner: any person having an interest whether legal or equitable, sole or partial, in real property which is, or which may in the future be, served by the facilities of the County.

Peak Daily Flow - PDF: the maximum flow rate determined by use of the appropriate peaking factor times the average daily flow or as measured directly over a 30 day period for existing developed areas.

Person: any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, county, city, town or any other political subdivision of the state, any interstate body or any other legal entity.

Policy: a procedure developed to carry out functions and goals as established by the County's sewer ordinance and standards.

Premises: any building, group of buildings, or land upon which buildings are to be constructed which is or may be served by the facilities of the County.

Premises having access to the facilities of the County: any improved premises which abut a highway, street, easement, alley, or other public space in which the facilities of the County are located; the improvements to be served on such premises shall be located no more than 300 feet from facilities of the County and shall be served by gravity flow.

Premises having service available: any premises, whether improved or unimproved, which abut the facilities of the County or a right-of-way in which such facilities are located and which could be served by such facilities but is deemed not to be a premises having access to the facilities of the County because such premises are unimproved or because of distance between the facilities and the improvements on the property or because the installation of an individual grinder pump would be necessary to serve improvements on the property.

Pretreatment: an on-site process to reduce, alter and/or change wastewater characteristics prior to discharging the wastewater into the public sewer system.

Primary service area: an area or areas designated by the governing body for current or future emphasis in the provision of public sewer service based on plans for future development of the County.

Private sewer system: a sewer system owned by one or more persons as opposed to a facility of the County.

Public sewer: a sewer system owned and operated by the County, HRSD or any adjoining city or county.

Public Sewer Extension Agreement: a contract authorized by the governing body between the County and a developer for the extension of the public sewer system by a developer.

Pumping chamber: a below-grade compartment into which sewage flows from a septic tank and from which the effluent is pumped to an elevated sand mound or a low pressure distribution system.

Reliability: a measure of the ability of a component or system to perform its designed function without failure or interruption of service.

Septic tank: a tank which provides for the settling of heavy solids as well as oil and grease skimming and the conversion of sanitary sewage to an anaerobic state.

Service charge: a periodic charge levied to defray costs associated with the construction, operation, maintenance, repair, and replacement of public sewer.

Sewage: that water carried waste which derives principally from dwellings, businesses, institutions, industry and the like exclusive of any storm, surface and/or ground water.

Sewer: a pipe or conduit for carrying sewage.

Sewer system: all facilities for collecting, pumping, treating, and disposing of sewage.

Site Plan: a required plan submission, prepared and approved in accordance with the provisions of Article V of the York County Zoning Ordinance, which depicts and provides design details on the proposed improvements on a site.

Soil absorption area: the soil medium beginning at grade which includes the soil, gravel or sand interface used for absorption of septic tank effluent. The absorption area includes the infiltrating surface in the absorption trench and the soil between and around the trenches.

Soil Absorption System, general: on-site sewage systems which utilize the soil to provide final treatment and disposal of effluent from a septic tank in a manner that does not result in a point-source discharge and does not create a nuisance, health hazard or ground or surface water pollution. Soil absorption systems subject to approval in York County are further classified as follows:

1. Conventional: an on-site disposal system that utilizes a septic tank(s) for preliminary treatment and from which the effluent flows by gravity directly to a soil absorption area for final treatment.
2. Elevated mound: an on-site system designed by an engineer currently licensed to practice in the Commonwealth of Virginia that utilizes a septic tank(s) for

preliminary treatment and from which the effluent discharges by gravity to a pumping chamber. It is then pumped to an elevated sand mound for intermediate treatment prior to percolating to an absorption area for final treatment.

3. Low pressure: an on-site system designed by an engineer currently licensed to practice in the Commonwealth of Virginia that utilizes a septic tank(s) for preliminary treatment and from which the effluent discharges by gravity to a pumping chamber. It is then pumped into a pressurized system for uniform distribution over a soil absorption area for final treatment.

Special Developments: land uses other than residential or typical commercial / industrial development.

Standards: means the sewer standards and specifications of the County.

Storm drain or storm sewer: a system which carries storm or surface waters or drainage, but excludes sewage.

Subdivision: the division of a lot, tract or parcel of land into two or more lots, tracts or parcels for the purpose, whether immediate or future, of transfer of ownership or development.

Sub-main Sewers: a sewer pipeline that receives, or will receive, flow from one or more lateral sewers.

Temporary privy: a privy with a tank for collection of human excrement to be used for specified periods and cleaned weekly or more often.

Trunk Sewers: Main line sewer.

User: any person who contributes, causes, or permits the contribution of wastewater into the public sewer.

Vacuum system: a negative pressure system of wastewater transport utilizing differential air pressure to create flow, as opposed to gravity-induced flow of conventional wastewater collection systems.

Warranty/Guarantee Period: means the period of time stipulated in PSEA wherein the developer of the sewer facilities is responsible for the correction of any deficiencies in materials and/or workmanship discovered during that specified period of time.

Wastewater: sewage.

Wastewater system: sewer system.

C. Quantity of Sewage Flow:

The volume of sewage shall be determined by considering the future use capacity requirements of the sewer service area as defined by York County (as provided by the Department of Environmental and Development Services) for the particular section of sewer under construction. The following parameters shall be used when determining the average daily flow of sewage:

1. Design Basis for New Developments: Table 1.1
2. Industrial and commercial areas: based on known building and staffing data or by the formula in Figure 1.1:

Figure 1.1

A = acres

FD = Flow Duration (hours) See Table 1.1

ADF = Average Daily Flow (gallons)

$$\frac{0.25 \times A \times 43560 \frac{sf}{acre} \times \frac{250 gpd}{1000 sf}}{FD \times \frac{1 day}{24 hrs}} = ADF$$

3. Special developments: detailed studies to determine the average daily flow of sewage will be required.

In addition to the above specified average daily sewage flows, consideration shall be given to the peak daily sewage flow. In general, laterals and sub-main sewers shall be designed to carry, when flowing full, at least four times the average daily flow. Main and trunk sewers shall be capable of carrying, when flowing full, at least two and one-half times the average daily flow. The hydraulic grade line for all conditions of flow shall be below the crown of the sewer.

To aid in the review of development projects, a standardized format for an "Engineer Design Calculations Report" and a "Sanitary Sewer Design Summary" is provided in Appendix E. Engineers are advised that certain plans require that flow certificates be obtained from the Hampton Roads Sanitation District (HRSD). See Appendix G for criteria and sample permits.

TABLE 1.1

DESIGN BASIS FOR NEW DEVELOPMENTS

<u>TYPE OF DEVELOPMENT</u>	<u>DESIGN UNITS</u>	<u>FLOW (GPD/UNIT)</u>	<u>FLOW DURATION (HR)</u>
Single Family Sub.	# Homes	300	24
Apartment Complex	# Units	250	24
Retirement Apartments	# Units	225	24
Condominium	# Units	250	24
Manufactured Homes	# Units	250	24
Office Building	Gross Sq. Ft.	0.10	12
Medical Offices	Gross Sq. Ft.	0.175	12
Clinic	Gross Sq. Ft.	0.40	12
Nursing Home	# Beds	130	24
Hospital	# Beds	350	24
Restaurant	# Seats	35	16
Carry-out (Chain)	# Seats	15	16
Motel	# Units	130	24
Laundromat	# Machines	500	16
Service Station	Gross Sq. Ft.	0.18	16
Convenience Store	Gross Sq. Ft.	0.15	24
Warehouse	Gross Sq. Ft.	0.02	24
Shopping Center	Gross Sq. Ft.	0.20	12
Grocery Store	Gross Sq. Ft.	0.20	12
Beauty Salon	Gross Sq. Ft.	0.35	12
Gift Shop	Gross Sq. Ft.	0.04	12
Hardware Store	Gross Sq. Ft.	0.04	12
Bar/Night Club	# Seats	10	8
Auto Dealership	Gross Sq. Ft.	0.08	12
Vet. Clinic	Gross Sq. Ft.	0.18	12
Bank	Gross Sq. Ft.	0.06	12
Drug Store	Gross Sq. Ft.	0.10	12
Theater	# Seats	1.5	12
Garage (Auto Repair)	Gross Sq. Ft.	0.015	16
Library	Gross Sq. Ft.	0.10	16
Bakery	Gross Sq. Ft.	0.15	12
Exercise Club	Gross Sq. Ft.	0.125	16
Racket/Tennis Club	# Courts	300	16
Pool	# Members	5	16
Elementary School	# Persons	6	8
High School	# Persons	7.5	8
School-Dormitory	# Persons	40	8
Nursery School	# Persons	4	8
Church	# Seats	4	6
Camping-Primitive	# Sites	30	24
Camping-Average	# Sites	40	24
Camping-Trailer	# Sites	75	24
Picnic Area	# Persons	5	24
Factory	Persons/8 hr. Shift	25	Operating Period
Timeshare (Vacation Ownership)	# Units	225	

D. Design Considerations - Gravity Sewers:

1. Minimum Size - No sewer shall be less than eight inches in diameter, except that sewer serving six connections or fewer on cul-de-sacs or sidewalk collector lines may be six inches in diameter provided that engineering calculations and justifications indicate that such size is adequate. Any six inch in diameter sewer that serves more than two lots shall terminate with a manhole unless approved otherwise by the Director. Six inch in diameter laterals that do not terminate in a manhole shall terminate with a standard York County clean-out assembly. The minimum size for a sewer lateral shall be four inches in diameter; however, six inch in diameter laterals are required for dual service connections, and when otherwise deemed to be necessary by the Director.
2. Minimum Velocity and Slope - All gravity sewers to be installed in York County shall be designed to give mean velocities, when flowing full, of at least 2.0 feet per second. Computations of full-flow velocity shall be based on Manning's formula using an "n" value of 0.010 for PVC pipe and 0.013 for other pipe.

Gravity sewers shall be laid with uniform slope between manholes. The minimum slope of gravity main line sewer shall be as listed in Table 1.2 or as otherwise approved by the Director during preliminary design due to unique circumstances. However, in cul-de-sacs, streets, or easements of less than 800 feet in length (provided it has been determined by the County not to be feasible to provide for future extensions in these locations), the eight inch gravity sewer main shall be laid with a minimum slope of 0.50 feet per 100 feet, unless otherwise approved by the Director.

TABLE 1.2

SEWER SIZE (INCHES)	SLOPE (FEET PER 100 FEET)
6	1.00
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

Decreased slopes shall only be considered where the design average flow depth will be 0.3 of the diameter or greater for design average daily flow. In no case shall the assumption of flow be more than can be expected from full development of the area based on criteria from Section I.A.

3. Maximum Velocity - In general, average flow velocities greater than ten feet per second shall not be permitted. Drop manholes shall be provided where required to eliminate steep slopes and to reduce high velocities to a limit of eight feet per second or less. Where it is impractical to limit velocities below eight feet per second, reasonable effort must be made not exceed ten feet per second. Where velocities are anticipated to exceed eight feet per second, restrained joint pipe and fittings may be required and the pipe shall conform to appropriate ASTM or AWWA specifications, which provide protection against internal erosion.
4. Depth of Sewers -
 - a. The minimum cover depth of all sewer lines shall be greater than the depth to the frost line. Lines with less than three feet of cover shall be ductile iron pipe.
 - b. Sewer lines installed at a depth measured 15 feet or greater from invert to finish grade shall be ductile iron. Sewer lines installed in fill sections shall also be ductile iron pipe with mechanical joints.
5. Alignment - Gravity sewers shall be laid with straight alignment between manholes.
6. Increasing Size - Whenever a smaller sewer enters a larger one, the same energy gradient must be maintained. An approximate method for securing these results is to match the 0.8 depth point of both sewers.
7. Easements - A minimum 20-foot wide easement, centered over the sewer, shall be conveyed to the County when facilities of the County are to be placed on private property (this width may be reduced by the Director). No building or permanent structure shall be constructed within these easements. No trees, shrubs, structures, fences or obstacles shall be placed within an easement, which would render the easement inaccessible, by equipment. Temporary construction easements, of varying widths, shall be acquired when necessary to facilitate wastewater system construction.
8. Horizontal and Vertical Separation - Sewers shall be laid at least ten feet, horizontally, from existing or proposed water mains. Should local conditions prevent a horizontal separation of ten feet, a sewer may be laid closer than ten feet to a water main if it is laid in a separate trench and the elevation of the top

(crown) of the sewer is at least 18 inches below the bottom (invert) of the water main. Where this vertical separation can not be obtained, the sewer shall be constructed of AWWA specified pressure type pipe having mechanical joints or approved slip type joints and shall be pressure tested in place in accordance with the most recent edition of the AWWA Standard to 50 psig prior to backfilling. See Standard Details located in the appendix.

When sewers must cross under water mains, the sewer shall be laid such that the top of the sewer is at least 18 inches below the bottom of the water main. If local conditions prevent this vertical separation, the sewer line shall be constructed from a full length section of AWWA specified pressure type pipe having mechanical joints or approved slip type joints for a minimum distance of ten feet on each side of the water main. This section of the sewer line shall be pressure tested in place in accordance with the most recent edition of the AWWA Standard to 50 psig prior to backfilling. One full length of water main should be centered over the sewer so that the pipe joints of the water main will be as far as possible from the sewer. See Standard Details located in the appendix.

When sewer must cross over water mains, the sewer shall be laid such that the bottom of the sewer is a minimum of 18 inches above the top of the water main. The sewer line shall be constructed from a full length section of AWWA specified pressure type pipe for a minimum distance of 10 feet on each side of the water main. This section of the sewer line shall be pressure tested in place in accordance with the most recent edition of the AWWA Standard to 50 psig prior to backfilling. The crossing shall have adequate structural support to prevent damage to the water main. See Standard Details located in the appendix.

In addition to the requirements specified above, a water main shall not be allowed to pass through or come into contact with a sewer manhole.

9. Materials - Sewer piping material shall be of the same type material from manhole to manhole except where a rigid coupling designed specifically for transitioning between the two types of materials is approved for use by the Director.
10. Polyethylene Encasement – an approved polyethylene encasement material shall be provided on all ductile iron pipe in areas where corrosive soils exist. It shall be the burden of the Developer to satisfy the County as to the extent and aggressiveness of corrosive soils.

E. Design Considerations - Manholes:

1. Location - Manholes must be installed at the end of each gravity sewer main line; at all changes in line size, slope or alignment; and at all intersections. Manholes on sewers 24 inches and less shall be placed at intervals not greater than 400 feet. For sewers larger than 24 inches, the maximum interval shall be 500 feet.

Manholes may be standard type, shallow, straddle, deep, or drop (inside or outside). See Appendix H for details.

2. Drop Type - Drop pipes shall be provided for all main line sewers entering a manhole at an elevation greater than 24 inches above the manhole invert. Wherever the difference in elevation between the incoming sewer and the manhole invert is 24 inches or less, the manhole invert shall be installed with a fillet to prevent solids deposition. Interior drop manholes shall have a minimum interior diameter of 60 inches. Generally, only one interior drop is permitted per manhole, multiple interior drops must be approved on a case by case basis.
3. Diameter - The minimum interior diameter of gravity sewer manholes shall be 48 inches for manholes less than 12 feet in depth and 60 inches for manholes 12 feet and greater in depth. In addition, the minimum interior diameter of the manhole shall be no less than the interior diameter of the largest sewer entering the manhole plus 18 inches.
4. Boot Connections - All pipe connections into manholes shall be installed by the core and flexible boot method.
5. Head Loss in Manholes - All changes of direction, size or shape of sewers shall be made by gradual transitions so as to minimize head loss in manholes. The designing engineer shall take into consideration the head losses occurring at all manhole inlets and outlets. Manholes should be designed with a minimum 0.1 foot drop in elevation from the inverts of the inlets to the invert of the outlet. The elevation of the inverts of all inlets and the outlet shall be shown on the plans along with the elevation of the top of the manhole.
6. Depth - Manholes with a depth greater than 12 feet shall have at minimum 60 inch inside diameter barrels for the entire depth. Manholes shall be designed by a professional engineer when depths exceed 25 feet.
7. Frames and Covers - Manhole frames and covers shall be set at elevations to exclude surface water. Concrete adjustment rings may be used to adjust manhole rim elevations up to 12 inches. A one foot barrel riser section must be used in adjustments greater than twelve inches. In undeveloped areas the rim elevation shall be set 18 inches above the existing ground elevation. In areas subject to flooding, watertight manhole covers are required to be used. Where a series of watertight manhole covers are used on a main line sewer for a distance of 1,000 feet or more, vent pipes are required.
8. Manholes Receiving Force Main Discharge - The interior of manholes receiving a force main discharge (other than from an individual residential grinder pump force main) shall be coated with an approved coating material. The interior of

downstream manholes for a distance not less than 1,000 linear feet must also be coated with the acid resistant material.

9. Manhole Coating - The interior of manholes shall be coated with an approved acid resistant material.
10. Service Connections - A maximum of three service connections may be installed into one manhole. When the service connection is to be installed into an existing manhole, a boot connector or a full joint of ductile iron pipe must be used. When joining ductile iron to other pipe materials, a rigid connection designed specifically for transition of the two types of material is required. Corings for boot connectors shall not be within six inches of a manhole barrel section joint. When more than one service connection is installed in a manhole, the connections shall be staggered vertically as shown in the Standard Details (see Appendix H).

F. Design Considerations - Force Main:

1. Force mains shall be four inches or larger in diameter. However, if the system is served by a grinder pump, an exception may be granted by the Director.
2. At pumping capacity, a minimum scouring velocity of two feet per second is required. The maximum velocity is eight feet per second. Where velocities within a force main will exceed eight feet per second, restrained joints will be required and the pipe shall conform to appropriate ASTM or AWWA specifications which provide protection against internal erosion.
3. Manual air relief valves are to be installed at high points in the force main.
4. When a force main terminates into a gravity sewer system, it must enter the receiving manhole with an invert elevation that will ensure a smooth flow transition to the gravity sewer system. In no case shall the force main enter the gravity sewer system at a point more than one foot above the flow line of the receiving manhole. An inside drop connection should be used to terminate the discharge flows of a force main within a sewer manhole.
5. Receiving manholes shall be coated with an approved acid resistant bitumastic coating (other than individual residential grinder pump force mains). The interior of downstream manholes within 1,000 linear feet must be similarly coated.
6. Force mains must have a minimum depth of cover of 36 inches and should not exceed 48 inches, unless a greater depth is specifically approved by the Director.
7. Pressure and leakage tests shall meet or exceed the latest requirements of AWWA C 600.

8. Ductile iron (DI) pipe with restrained joints is required for force mains larger than two inches in diameter that are to be installed in casing that cross VDOT rights-of-way.
9. Force mains shall be designed and constructed to have a uniform positive or negative grade.

G. Design Considerations - Pump Stations:

All sewage pumping stations constructed within the County of York shall be designed in accordance with the Commonwealth of Virginia "Sewerage Regulations," Section 22, as promulgated by the State Department of Health and the Virginia Department of Environmental Quality and the following requirements described below, and shall satisfy the requirements of the County of York Division of Building Regulation. All stations shall be designed to minimize air entrainment and odor generation.

1. Class I Reliability - Sewage pumping stations shall meet Class I Reliability as defined in the Commonwealth of Virginia "Sewerage Regulations." Class I Reliability can be attained by one of the following:
 - a. Storage Capacity - The station wet well and collection system must have the required excess storage capacity to prevent sewage overflows; or
 - b. Emergency Standby Power Generator - The station will have an emergency power supply in the event of a power failure.
2. Design Flow - Consideration shall be given to the degree of present and future development. Therefore, design flows shall be based upon a population estimate for the area to be served. The area to receive the pump station design flow shall be evaluated to determine required capacity. The pump station shall also be designed to accommodate peak flow rates. Peak flow rates are defined as being 2.5 times the average design flow or as further allowed by the "Sewerage Regulations." The design flows used for the design of sewage pump stations is discussed in Section I.A. of this document.
3. Wet Well Requirements -
 - a. The effective capacity of the wet well should be such that one pump will run continuously at least five (5) minutes during a thirty (30) minute period of minimum flow at ultimate design conditions.
 - b. Ventilation: The wet well must be mechanically ventilated to achieve the following:

- 1) Continuous ventilation: There must be twelve (12) complete air changes per hour.
 - 2) Intermittent ventilation: There must be thirty (30) complete air changes per hour.
- c. The wet well interior must be painted with two coats of Seatar 1010 or other approved coating material.
 - d. The influent sewer line shall have an open flange connection within the wet well and have a bar screen with a maximum clear opening of two and one-half inches. Pumps handling raw sewage shall be protected by a readily accessible bar screen that has a clear opening that does not exceed two and one-half inches. Design consideration shall be given to the loss of head through the bar screen. The bottom of the screen channel shall be placed at least twelve (12) inches below the invert of the incoming sewers to allow for some accumulation of screenings without affecting the flow in the sewers. The floor of the screen chamber shall be above maximum high water level in the wet well. Adequate clearances for ease of maintenance shall be provided.
 - e. All interior metal work is to be of aluminum or other non-corrosive metal.
 - f. All electrical fixtures are to be explosion proof and located in serviceable locations. Interior electrical conduit shall be plastic coated rigid metal or approved PVC conduit. All conduit shall be non-corrosive. Seals shall be installed in the conduit to prevent gases from traveling to the panel box.
 - g. Access to the wet well will be by permanently installed stairs. Hatches shall be flush with floor and have a keyed recessed locking mechanism. All hatch hardware shall be of stainless steel material.
 - h. The wet well bottom fillets are to have a minimum slope ratio of 1:1.
 - i. The wet well landing area shall have removable grating to permit access for washing the wet well walls. Gratings shall be aluminum or fiberglass of equal strength.
 - j. Inlet sewer and sump discharges shall enter into a drop pipe that extends below the low pump vent water level to reduce air entrainment in the wet well.

4. Pump Room Requirements -

- a. The pump room must be sized for ease of maintenance. A minimum of three (3) feet shall be provided from major pieces of equipment to the next piece of equipment or wall.
- b. Access and handling facilities shall be designed to facilitate removal and reinstallation of pumps.
- c. The pump room below grade shall conform with the following:
 - 1) Sump pump: The pump discharge is to be located above the wet well high water elevation
 - 2) Pumps shall be installed on raised blocks.
 - 3) Electrical outlets are to be installed three (3) feet or higher above the slab elevation. Installation shall include NEMA Type "4 X" enclosures.
 - 4) All lights are to be accessible from both the bottom slab and the stairs.
 - 5) The motor and pump controls are to be on or above existing ground elevation.
 - 6) All interior piping is to be supported by concrete pedestals and approved hangers and shall be blocked or braced.
 - 7) Ventilation: The dry well pump room must be mechanically ventilated.
 - 8) All ventilating equipment shall be corrosion resistant and explosion proof.
 - 9) Switches to de-energize each motor with a lockout button shall be provided in a NEMA Type "4 X" enclosure.
 - 10) A dry pit submersible pump installation is preferred.
 - 11) A low temperature dehumidifier shall be installed in the dry well; the drain shall be piped to the sump with PVC pipe.

5. Motor Control Room Requirements -

- a. The pump station motor control room shall be located at or above ground elevation.
- b. Motor control room structure:
 - 1) Will be constructed of brick or masonry block with brick veneer on concrete slab.
 - 2) Will not have windows.
 - 3) Access to the control room must be of sufficient size to allow the removal of installed equipment.
 - 4) A finished ceiling with insulation is required.
- c. Motors are to be mounted on concrete blocks secured with dowels to the floor slab.
- d. Station electrical and control wiring must meet County and NEC codes and contain a main disconnect.
- e. Motors shall be three (3) phase sixty (60) cycle (200, 240 or 480 voltage) unless specifically approved otherwise.
- f. Municipal water service supplied to the station must utilize an approved backflow preventer (RPZ type). Hose bibs are to be conveniently located inside the station (one in the control room and one in the dry well).

6. Pump Selection Criteria -

- a. Flygt (CT configuration), or an equivalent providing the same level of service and maintainability, shall be installed for all wetwell/drywell stations.

One (1) set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

The manufacturer shall furnish the following spare parts for each size pump supplied:

- 1) 1 - upper bearing.
- 2) 1 - lower bearing.
- 3) 1 - set of upper and lower shaft seals.

- 4) 1 - set of "O-Rings" or gaskets required for replacement of bearings and seals.
- 5) 1 - set impeller wear rings (replaceable type).
- 6) 1 - shaft sleeve (if applicable).
- 7) 1 - cable cap (if applicable).

Spare parts shall be properly packaged and labeled for easy identification without opening the packaging and suitably protected for long term storage under humid conditions. Spare parts and tools shall be delivered to the County at or prior to the time of pump station start-up.

- b. Each station shall contain a minimum of two (2) pumps, each capable of pumping the design peak flow. Pump stations with a design peak daily flow rate of 70 gpm or less may be submersible grinder stations equipped with mixer assemblies. The mixer assembly shall be of the "Fixiflush" valve type or approved equal. Pump stations with a design peak daily flow rate of 175 gpm or less may be wetwell submersible stations. Pump stations with a peak design flow of 1500 gpm or more must provide for three (3) pumps unless otherwise approved by the Director. Pump stations with less than 1500 gpm peak design flow may have 3 pumps upon approval of the Director.
- c. Pumps must be sized to pass a three (3) inch solid. This requirement will be waived for grinder pumps.
- d. Pump volutes shall be vented to air via piping to the wet well.
- e. Air release valves shall be installed on all suction lift pumps.
- f. Flood suction and grinder pumps must maintain a positive prime.
- g. When discharging into the Hampton Roads Sanitation District force main system, both minimum and maximum HRSD pressures shall be considered in the pump selection. The pumps shall operate efficiently without cavitation, under existing and proposed future head conditions. The installed pumps shall be capable at a minimum of conveying the average daily flow entering the station (at build-out) against future HRSD head conditions.
- h. A device for measuring sewage flow shall be provided in pumping stations that discharge directly into the Hampton Roads Sanitation District (HRSD) interceptor system. The device shall contain totalizers and daily recording charts, which measure flow in multiples of one thousand (1,000) gallons per day.

- i. An elapsed time meter is required for each pump motor. Meters shall be installed at "eye" height.
- j. A four and one-half inch stainless steel cased, liquid filled pressure sewer gauge measuring in increments of two (2) psi with a range of 0 - 60 psi shall be provided for each pump. The gauge location shall be on the pump side of the discharge gate valve.
- k. Submersible wet well pump installation shall include a mixer/flush valve attachment.
- l. A Red Valve Series 742 "diaphragm seal" or approved equal, shall be installed in series with the pump bleed-off lines to monitor discharge pressure. A 0-60 psi liquid filled gauge shall be installed with the sensor (with 1/2" NPT connections).

7. Station Piping Requirements -

- a. All interior piping sizes of four (4) inches or larger in diameter shall be Class 52 bituminous coated and cement-lined ductile iron pipe. In addition, all pipe joints located within a station shall have bolted flange connections.
- b. Allowable velocities:
 - 1. Suction pipe velocities shall be in the range of two (2.0) to five (5.0) feet per second (Self priming pump suction velocity may exceed five (5.0) feet per second).
 - 2. The force main discharge rate of flow shall be greater than two (2.0) feet per second but less than eight (8.0) feet per second.
- c. An emergency station bypass connection must be provided on the discharge line.
- d. A gate valve and a check valve shall be placed on the discharge side of each pump.
- e. In addition to d. above, a gate valve shall be placed on the suction line of flooded suction pumps.

8. Control Panel and Motor Controllers

- a. General. Provide a complete control panel with a purged air bubbler system for controlling the sequence of operation of the two sewage pumps.

The panel, in a NEMA-12 enclosure with hinged cover, shall include an air supply system, combination low pressure gauge (mounted outside of panel for draining of condensation), air rotameter solenoid valve for push-button purging, G.E. "Series One Junior" programmable controller with appurtenances, wet well level indicating gauge, and all necessary timers, relays, push-buttons and indicating lights to perform the following required functions:

- 1) Start pumps on rising level.
- 2) Stop pumps on falling level.
- 3) (not used)
- 4) Indicate wet well level.
- 5) Alternate pumps to equalize wear.
- 6) High pressure purge of bubbler pipe.
- 7) Prohibit pumps from running if voltage on any phase of the incoming power supply drops to 75% of normal voltage or if there is a reversal of phases on the incoming power supply.
- 8) (not used)
- 9) Stop a pump on a failure-to-pump and signal to the alarm transmitter.

b. Level Sensing and Indicating.

- 1) Provide a Thomas LGH-310 or 210 duplex air compressor assembly with manual alternator on a 12 gallon receiver tank for supplying air to the bubbler system. The compressors shall be air cooled, single stage reciprocating type and shall be complete with suction muffler-filters, check valves, automatic on-off switches, "Low Air Pressure" alarm signal, pressure gauge, safety valve, outlet needle valve and tank drain with valve. Compressors shall be of the oil-less type. Motors shall be 1/3 horsepower, 115 volts, 60 cycle, single phase with integral thermal overload protection. The air receiver shall be ASME stamped for unfired pressure vessels. A separate 120 volt, 60 cycle, circuit shall be provided to the control panel for power to the air compressors and for operation of internal control components.
- 2) A combination pressure reducing valve and filter shall be furnished. The regulator shall be of the relieving piston type with a snap-type lock on the adjustment knob. A 0-30 PSI pressure gauge shall be provided. The filter shall have a 5 micron centered bronze element and manual drain.

- 3) The air purge rotameter shall be provided with a range of 0-5 SCHF. It shall have a corrosion resistant body and inlet needle valve.
- 4) Solenoid valves shall be provided for high pressure purging of the bubbler line. Valves shall have stainless steel bodies and plungers, and BUNA-N inserts to provide bubble tight sealing. They shall have a minimum operating pressure differential of 150 psi.
- 5) Pressure switches shall be provided for the control of the start-stop operation of each pump and any other functions required. Each pressure switch shall have two direct acting, single-pole, double-throw micro switches operated by a single diaphragm. The diaphragm shall be made of welded beryllium copper and shall fit in a contoured chamber for over-pressure protection. A wrench plate shall be provided to protect the diaphragm from rough handling. Pressure switch adjustment shall be made by easily accessible, front mounted, self-locking adjustment screws. Each adjusting screw shall have a calibrated dial to lock-in the air adjustment. A cover shall be provided over the adjusting screws, which can be closed and sealed to prevent tampering while still allowing full view of the set point of the dial. Repeatability of the pressure setting shall be plus or minus 1/2%.
- 6) A flush, panel mounted, 4 1/2" diameter level gauge with a range of 0-160" water shall be furnished. The gauge shall have a brass bellows type pressure element, aluminum case and removable front ring.
- 7) Small submersible grinders will be reviewed on a case-by-case basis to determine if a float switch system is to be utilized.

c. Electrical Equipment. Provide the following electrical system components:

- 1) Benshaw solid state "pump-type" (which includes a de-acceleration feature), combination soft-start type motor starters and motor rated circuit breakers rated for the pump horsepower, 240 volt Delta, 3 phase motors. Provide with NEMA type 12 enclosures suitable for the corrosive fumes present in the station.
- 2.) Provide complete on-site instructions for the operation, adjustment and programming of the starters.

- 3) Relays and switches as necessary for lead, lag or alternate operation of the two pumps and for hand-off-automatic operation of each pump.
- 4) Relays and timers as necessary for failure-to-pump sensing; one system for each pump (limit switches for wet well/dry well applications and pressure sensors for submersible stations). Each system shall be designed so that when a pump motor is signaled to start by the level sensing equipment, or by the hand-off-automatic switch, a timer with a 0-30 second adjustable setting shall be actuated and the position of the limit switch on the discharge check valve for that pump shall be monitored. If the check valve does not open, pump motor shall be stopped and an alarm signal shall be sent to the existing alarm transmitter. It shall be necessary to reset a failure-to-pump system manually before normal pump operation can be resumed. If the check valve opens within the preset time, the system shall reset automatically for its next operation and the pump shall continue to run.
- 5) Power line sensing equipment shall be provided to continuously monitor and to shut down pumps when incoming voltage drops below 75% of rated value or if there is a phase reversal on the incoming power system. Systems shall automatically reset after the power system returns to normal.
- 6) Timers and relays as necessary to provide a time delay, adjustable from 0-30 seconds, for restarting a pump motor after a power interruption (failure of normal utility power supply system and transfer to the engine generator set or restoration of normal power and retransfer of loads from the generator set to it) and to allow only one pump motor to be started and brought up to speed at a time, regardless of how many pumps may be called for by the level sensing and control equipment.
- 7) Fully labeled terminal strips for connection of all incoming and outgoing service, load, control and alarm wiring. All internal wiring and conductors shall be labeled (identified) on each end.
- 8) Limit switches (or pressure sensors where appropriate) shall be provided on the check valves to shut down each pump in event of a failure to pump condition so as to prevent pump damage. Pressure sensors, located in the dry well valve pit, shall be installed in lieu of limit switches in submersible type stations.

- 9) Provide circuit breakers for lights, vent fans and convenience receptacles as may be required. A step down transformer may be required to control circuits and station auxiliaries.
- e. Operating Sequence. At a present point during a rise in wet well level, the first pump (the lead pump) shall be started, and it shall run as long as necessary to pump out the wet well to a low level pump cut off point. If the level continues to rise, the second pump (the lag pump) shall be started, and the two pumps then on line shall operate in parallel as long as necessary to pump out the wet well to the cut off point. The automatic alternating control circuitry shall switch the operating sequence of the pumps at each instance when all pumps are stopped. Provide a manual selector switch, which shall allow manual selection of pump sequence or automatic alternation.
 - f. Control Panel Door Arrangement. Install the following system components in the Control Panel Door, each wired and piped into the system for proper operation and each provided with an engraved, laminated, black-core white-background nameplate to indicate its function:
 - 1) White "Control Power On" pilot light.
 - 2) Green "Pump Running" pilot light; one for each pump.
 - 3) Amber "Failure-To-Pump" pilot light; one for each pump.
 - 4) Pushbutton to "Reset Failure-To-Pump System"; one for each pump.
 - 5) Hand-Off-Automatic selector switch; one for each pump motor.
 - 6) Six (6) digit running time meter reading in hours and tenths of an hour; one for each pump motor (to be mounted at eye height).
 - 7) Pump sequencing selector switch; "Pump #1 Lead - Pump #2 Lead - Automatic."
 - 8) (not used)
 - 9) Pushbutton to activate high pressure "Bubbler Line Purge."
 - 10) (not used)
 - 11) (not used)
 - 12) Wet well level gauge.
 - 13) Designation plate indicating name and address and phone number of manufacturer of the control panel.

9. Standby Power System -

- a. General - York County requires that all pump or lift stations be provided with a complete standby electric power system consisting of a Diesel engine driven generator set, an automatic load transfer switch, time switches, contactors, wiring, conduit, piping and accessories. The engine generator set and automatic load transfer switch shall be completely built,

tested and shipped by a manufacturer who has been regularly engaged in the production of such equipment and who has parts and service facilities locally available so there is one source of supply and responsibility. The performance of the electric plant shall be certified by an independent testing laboratory as to the plant's full power rating and voltage and frequency regulation. All equipment shall be guaranteed free from defects in workmanship and material for a period of 5 years or 1500 running hours from date of acceptance. An Authorized Distributor of the manufacturer shall inspect the equipment installation after it is completed and perform initial start-up and test of the system and shall submit a certificate of this inspection and test. The date of acceptance as referred to hereinbefore is defined as the date on which this certificate of inspection and test is received by the Owner. All equipment shall be listed by UL and so labeled. Equipment shall be manufactured by DETROIT, CATERPILLAR or GENERAC or as otherwise approved by the Director. Engine generator set shall be a diesel engine driven machine with a continuous standby rating of _____ KW, _____ KVA, 80% power factor, 208/120 volts, 3 phase, 4 wire, wye connected, 60 Hertz. It shall be complete with welded steel mounting base, vibration isolators, battery, exhaust silencer, flexible exhaust hose and fuel oil piping from the fuel tank.

- b. Engine - It shall be Diesel fueled, naturally aspirated or turbocharged, four cycle, water cooled with mounted radiator, fan and water pump. It shall have _____ cylinders with a minimum displacement of _____ cubic inches and a minimum rating of _____ bhp at its operating speed of 1800 rpm. Free turn, overhead valves shall be hard chrome-cobalt alloy faced. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have replaceable, full-flow, oil filter. Engine speed shall be governed by a pressure lubricated mechanical governor to maintain alternator frequency within 5 percent from no-load to full-load alternator output. Provide complete fuel injection system with electric motor driven fuel transfer pump and air cleaner with replaceable dry element. The engine shall have a battery charging alternator with rectifiers and a transistorized voltage regulator. Starting shall be by a 12 or 24 volt electric starter with electric solenoid shift. Complete engine control shall be 2-wire which operates to start engine on closing contact and to stop engine on opening contact. A cranking limiter shall be provided to open the starting circuit in approximately 45 seconds if the plant is not started within that time. The electric plant controls shall also include a 3 position selector switch with the following positions; RUN-STOP-REMOTE. High engine temperature, low oil pressure, and overspeed shutdown shall be provided. Selector switch shall be mounted on engine instrument panel as shall a common signal light which shall be illuminated when engine is shut down by cranking limiter, high engine temperature, low oil pressure or overspeed. In addition, provide a separate labeled signal lamp for each

of the engine shut-down malfunctions. Shut-down for any of these causes shall require manual resetting before engine can be restarted. Provide a set of normally open contacts to which a remote alarm can be connected to warn of any engine malfunction.

- c. Engine instrument panel - It shall contain an oil pressure gauge, water temperature gauge and battery charge rate ammeter in addition to selector switch and pilot lights as described above.
- d. Alternator (generator) - It shall be 4-pole, revolving field design with temperature compensated solid state voltage regulatory and brushless rotating rectifier exciter system. No brushes shall be allowed. The stator shall be directly connected to the engine flywheel housing and the rotor and shall be driven through a semiflush driving flange to insure permanent alignment. The insulation system shall be Class F as defined by NEMA MG1.1.65. Voltage regulation shall be within plus or minus 2 percent of rated voltage, from no load to full rated load. The instantaneous voltage dip shall be less than 13.0 percent of rated voltage when full load at rated power factor is applied to the alternator. Recovery to stable operation shall occur within 2.0 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1 percent of rated voltage. Rheostat shall provide a minimum of plus or minus 5 percent voltage adjustment from rated value. Temperature rise shall be within NEMA MG1-22.40 definition.
- e. Alternator instrument panel - It shall be provided adjacent to the engine instrument panel. The alternator instrument panel shall be wired, tested and shock mounted on the generating set by the manufacturer of the alternator. It shall contain panel lighting, manual reset main line generator output circuit breaker, frequency meter, running time meter, voltage adjusting rheostat, AC voltmeter (dual range, indicates all voltages), AC ammeter (dual range, indicates current each phase), and voltmeter-ammeter phase selector switch with OFF position.
- f. Mounting - The electric plant shall be rubber cushioned and mounted on a welded steel base, which shall provide suitable mounting on a 4" concrete slab.
- g. Accessories - They shall be provided as follows:
 - 1) Critical type exhaust silencer to reduce exhaust noise level to standards for critical areas;
 - 2) One 12 volt, nickel-cadmium battery with hydrometer, battery cables, rack and an automatic float/equalizer charger.

- 3) Engine coolant heater thermostatically controlled to aid in cold weather starting (supply from circuit breaker in station control panel);
 - 4) Fuel oil filter, solenoid valve and shut-off valve for fuel lines;
 - 5) Three sets of detailed operating, maintenance and service manuals complete with illustrated parts lists;
 - 6) Anti-freeze coolant in radiator and engine.
- h. Fuel piping - It shall be soft copper tubing, Type K. Flexible connections in fuel piping at engine shall be corrugated seamless bronze or stainless steel tubing with single wire braid. Valves shall be suitable for fuel oil service. Provide a shut-off valve in the fuel supply line at the engine. Strainers shall have steel housing with fiber treated cloth cone tube capable of removing particles 10 microns and larger. Provide a strainer in the fuel supply line at the engine.
- i. Exhaust piping - It shall be extra strong black steel pipe with screwed or welded fittings. Pipe hangers and supports shall be provided for exhaust piping and shall be adjustable type. Isolation supports shall be provided for all piping connections to the generator set. The finish of pipe hangers and supports shall be zinc or cadmium plated. The interior pipe and silencer shall be covered with six inches of calcium silicate rigid insulation butted firmly together and wired in place using 16-gauge wires on a 9-inch center. Insulating cement and/or glass cloth shall be applied over the insulation to achieve a smooth finish.
- j. Automatic load transfer switch - It shall be rated at ____ amperes, ____ volts, three-phase, 4-wire, 60 Hertz. The manufacturer shall furnish schematic and a wiring diagram for the particular automatic transfer switch and a typical interconnection wiring diagram for the entire standby system. The automatic transfer switch shall be rated for continuous operation in ambient temperatures -25 degrees F to + 125 degrees F. The transfer switch shall be rated for all classes of load, both inductive and noninductive, at 600-volts, and shall be designed, built, and tested to close on an inrush current up to and including 20 times the continuous rating of the switch without welding or excessive burning of the contacts. The transfer switch shall be capable of enduring 6000 cycles of operation, at rated current, at a rate of 6 cycles per minute, without failure. One cycle shall consist of complete opening and closing of both sets of contacts on an inrush current 10 times the continuous rating of switch. The automatic transfer switch, with terminal lugs for either copper or aluminum wire, shall have individual, heat resistant chambers enclosing solid silver cadmium oxide, doublebreak contacts. The transfer switch, with

mechanical and electrical interlocks to prevent simultaneously energizing both normal and emergency service, shall be mechanically held on both sides, with manual operator and auxiliary contacts rated 6-amp, 120-volt AC; 3-amp, 240-volt AC on both sides. It shall be wall mounted in a NEMA 12 enclosure. Control accessories shall mount on a dead-front, swing-out control accessory panel to avoid shock hazard while adjusting control functions, but will swing out exposing the wiring to facilitate servicing. Indicating lamps and meters shall be set in the front door of cabinet. Transfer switch shall be of the programmed transition type which shall provide dead band time adjustable from 1 to 10 seconds when the load is not connected to the normal power source, nor to the engine-generator. Control accessories shall be solid state type and shall provide the following functions:

- 1) Monitor each ungrounded line with calibrated dial, adjustable voltage, solid state UNDERVOLTAGE SENSORS to sense a decrease of voltage below a set point, or a loss of voltage on any phase or a reversal of phases on the normal power source. Voltage sensors shall be temperature compensated for 2 percent maximum deviation above the temperature range -25 degrees F to +175 degrees F.
- 2) Signal the engine-generator set to start in the event of a power disturbance as sensed by the monitoring system. A solid state TIME DELAY START (adjustable from 0 to 60 seconds) shall delay this signal to avoid nuisance startups on momentary voltage dips or power disturbances.
- 3) Retransfer the load to the line after normal power restoration. A TIME DELAY RETRANSFER (adjustable from 0 to 30 minutes) shall delay this transfer to avoid retransfer in case of short-term normal power restoration.
- 4) Provide an automatic RETRANSFER TIME DELAY BYPASS to retransfer the load from generating set to normal source if generating set output interrupts after normal sources restore voltage.
- 5) Signal the engine-generator to stop after load retransfer to normal source. A solid state TIME DELAY STOP (adjustable 0.5 to 5 minutes) shall permit engine to run unloaded to cool down before shutdown.
- 6) Provide a TEST SWITCH to simulate an interruption of power from the normal source.

- 7) Provide a constant-voltage automatic charging (1.40- 1.24 volts per cell) SCR, current limited, BATTERY FLOAT CHARGER to maintain fully charged cranking batteries.
- 8) Provide an EXERCISER CLOCK to automatically start the generating set at regular intervals and allow it to run for a preset time period, such as 30 minutes per week.
- 9) Provide WITH LOAD - WITHOUT LOAD SELECTOR SWITCH to select test or exercise as follows:

"without load", the generating set runs unloaded.

"With load", the automatic transfer switch transfers load to generating set, after time delay, the same as it would for a normal source interruption.

- 10) Provide a CONTROL DISCONNECT PLUG to electrically disconnect the control section from the transfer switch for maintenance service during normal operation.
- 11) Provide two (2) auxiliary relays or auxiliary contacts on the main power contractors (normal and emergency) so that a remote alarm or light can be connected to indicate that normal power has been lost and that power is being supplied from the engine generator set.
- 12) The automatic load transfer switch and/or the generator control panel shall have relays and wiring which provide contacts for closure in the event of a generator-set failure after transfer to emergency power. The contacts shall be made available for connection to the existing alarm transmitter.
- 13) Provide two (2) sets of auxiliary contacts to be actuated when the transfer switch is in the normal position and two (2) sets of auxiliary contacts to be actuated when the transfer switch is in the emergency position.
- 14) Provide a "neutral" position timer (adjustable from 0-10 seconds) to allow loads, such as motors, to come to a complete stop before being transferred to another source.

- k. Installation - The engine-generator set and automatic load transfer switch shall be installed in strict accordance with the recommendations of the manufacturer and with all applicable codes and regulations. Engine-generator sets shall be mounted on a concrete foundation isolation pad.

All connections to it shall be made with flexible pipe, conduit, etc., to minimize transfer of vibration.

- l. Quality Assurance - Prior to shipment, the following tests shall be conducted at the plant of the manufacturer, and certified results of these tests shall be delivered to the Engineer for transmittal to the Owner:

Full load test of the generator set for one hour with fuel consumption, output voltage, engine speed, voltage- and speed-regulation and generator winding temperature measured and recorded at ten-minute intervals.

- m. Start-up and Training - The services of a factory trained and factory authorized technician shall be available, and he shall perform complete start-up services on the engine-generator set after it has been set in place and connected. Upon successful start-up, the technician shall conduct one day (eight hours) of training in the operation and maintenance of the standby power system for York County Utility personnel.

10. Alarm Transmitter -

The pump station alarm system shall be a Motorola Modular Remote Terminal Unit (MOSCAD) (two-way microprocessor remote terminal unit). The MOSCAD unit shall be equipped with a 16-input status module encoder (with local LED display) and a mixed I/O module and a decoder which provides unit operational self-diagnostics. One relay output (Form A, low current, momentary) shall also be supplied. The power supply shall be 115 VAC 60 Hz. The AC power supply shall include a battery float charger and a 12 V/5 AH sealed lead acid back-up battery. The MRTU Plus shall be mounted in a NEMA-4 rated metal housing with space for up to four (4) expansion modules. The MRTU Plus shall include a two-way radio with a housing mounted type-N female antennae connector.

The MOSCAD package (F6956) shall be equipped with the following:

- a. 16 DI Module V 115
- b. Mixed I/O Module V 235
- c. NEMA 4 rated housing

- d. 115/230 VAC power supply
- e. Battery back-up operation with charger
- f. Tamper alarm on MRTU Plus housing door with keylock
- g. One (1) VHF pager (Model No. AO3KLC5662AA)
- h. Yagi antenna (Model No. ASPG962)
- i. Grounding kit (Model No. 204989-1)

The following alarm transmitter contacts shall be wired to a separate terminal strip:

- a. High water
- b. Pump #1 failure
- c. Pump #2 failure
- d. Commercial power failure
- e. Pump #3 failure (where applicable)
- f. Auxiliary power (when generator is running) from auxiliary contact on transfer switch
- g. Auxiliary power fail (when generator is running and fails during period of operation)
- h. Air bubbler failure (loss of air pressure in bubbler line)
- i. Seal failure (submersible pumps)
- j. High water alarm
- k. Dry well flooding
- l. Door open alarm
- m. Additional alarm contacts may be required on a case-by-case basis.
- n. Battery back-up supply and a test function

11. Tower -

The antenna tower shall be a Rohm or approved equal self-supporting tower set at a height determined by Motorola's RF Path Survey and taking existing and potential tree height into consideration. The tower shall support a directional antenna (Yagi Model No. ASPG962) and required length of 1/2" transmission cable (Motorola No. TDN6599). The tower shall be installed with all manufacturer's specifications, EIA standards, FCC regulations, FAA requirements, and other applicable local, state and federal regulations. The tower and cable shall be properly grounded using a minimum of three 8-foot by 5/8-inch copper clad rods attached by proper bonding to the three legs of the support tower.

The antenna tower shall be of sufficient height to transmit without interference from physical obstructions.

12. Wet/Dry Well Pumping Station Construction -

- a. Pumping station substructures shall be of reinforced concrete construction. All exterior walls below grade must be coated with an approved coating compound such as Seatar 1010. Superstructures shall be of brick masonry construction and shall have similar architecture and colors as adjacent buildings and surroundings. Other building components are:
 - . Shingles - fiberglass, fungus resistant, minimum 25 year warranty
 - . Louvers - Anodized finish with bird screen
 - . Doors - Fiberglass reinforced plastic (or as otherwise approved by the Director)
 - . Hinges - "Five Knuckle Full Mortise" polished steel with stainless steel pins
 - . Lockset - Cylindrical with stainless steel chassis; to meet ANSI A156.2 Series 4000, Grade I
- b. A paved entrance and a parking area shall have a minimum twenty-five (25) foot turning radius provided. A six (6) foot or higher chain link fence, with green or black vinyl colored fence fabric, shall enclose the pump station site, unless otherwise approved by the Director.
- c. A suitable and safe means of access shall be provided to dry and wet well pump stations. Stairways shall be installed with rest landings at vertical intervals that do not exceed ten (10) feet. Stair treads shall be of a non-slip type and a minimum width of thirty-six (36) inches (except for spiral ladders, which shall have a minimum width of thirty (30) inches).
- d. Provision shall be made to facilitate the removal of pumps and motors and the generator set. Adequate floor openings, doorways or floor hatches shall be provided. Eye-bolts, trolley beams, trolley and chain fall for hoisting equipment shall be installed. Sufficient clearance between equipment and storage walls shall be provided for ease of maintenance and to meet all applicable code requirements.
- e. Dry well base floor surfaces shall be sloped to a drainage trough toward the sump pump.
- f. Railings for stairs and floor openings, equipment guards and OSHA approved switchboard matting in front of electrical panels and transfer equipment are required.
- g. Electrical equipment and wiring shall be insulated and properly grounded. Switches and control shall be of the non-sparking type.

- h. Adequate lighting shall be provided in all locations including: outside, motor control room, dry well and wet well or as specified.
- i. Electrical equipment in enclosed places where gas may accumulate shall comply with the NEMA Class I, Div. 1, Group D, specifications for hazardous conditions.
- j. An adequate supply of potable water shall be provided for use in the pumping station. There shall not be a physical connection between the potable water supply and the sewage pumping station which could cause contamination of the potable water supply.
- k. The pump station site shall include a buffer area as required by the York County Zoning Ordinance. As a minimum, the pump station wetwell will be 100 linear feet from the nearest proposed structure in new developments. The requirements of the State Department of Health must be met for stations designed for use in an existing development.
- l. Pump station sites shall be landscaped as required by the York County Zoning Ordinance.

H. Design Considerations - Vacuum Sewerage Collection Systems:

- 1. Except as provided for in subparagraph H.4 below, the use of vacuum sewerage collection systems is limited to installations by York County to serve existing platted residential areas. The design of vacuum collection systems shall be in accordance with the Virginia Sewerage Regulations as promulgated by the State Department of Health and the Virginia Department of Environmental Quality.
- 2. The vacuum station and collection system approved for installation in existing residential areas by the County of York is the AIRVAC system manufactured and supplied by AIRVAC of Rochester, Indiana.
- 3. The vacuum station and collection system shall be designed in accordance with the AIRVAC Vacuum Sewerage System Design Manual dated June 1996 and as amended by that firm.
- 4. Vacuum sewer collection systems may be extended to serve undeveloped areas when the County has installed a vacuum sewer system to serve the area or adjacent areas and one of the two following provisions is applicable:
 - a. The undeveloped parcel or parcels have not been, and are not proposed for subdivision, and the owner or a previous owner paid an initial connection fee in accordance with Section 18.1-62(c), (e), or (f) of the York County Code. (This provision is also intended to permit the owner of an improved or unimproved parcel that abuts a County installed vacuum sewer line and

which existed at the time of the installation of the County system to connect to the system by payment of the applicable connection fees and extension costs at a later date.)

- b. The developer has submitted a request to the County to consider an extension of the vacuum sewer collection system and the County has determined by resolution adopted by the Board of Supervisors that the existing vacuum system has adequate capacity to serve the undeveloped area, and service by vacuum sewer is in the best interests of existing sewer customers and would, from an engineering standpoint, benefit the development and maintenance of the sewer facilities of the County. The determination by the Board shall also take into consideration the overall impact of the development on the environment and whether allowing the extension of the vacuum sewer will have a detrimental effect which would not otherwise occur.

In the event a resolution of approval is adopted by the Board, the developer shall enter into a contract as provided for in Section 18.1-53(b) of the York County Code and such extension shall be deemed to be serving an area outside of a primary service area. (The provisions of Section 18.1-65(d) and 18.1-54(c)(3) shall apply in establishing the terms of the extension agreement.) In addition, the contract shall provide for the contribution by the developer of an amount equal to \$2,500 for each lot to be connection to the proposed vacuum system in addition to all required fees as an offset for projected increased construction inspection cost and maintenance expense over the life of the system. Such contracts do not require additional Board approval.

5. Contractors engaged to construct vacuum sewer collection system extensions must be approved by the County.

I. Design Considerations - Private Wastewater Disposal System:

1. Septic Tanks, Low Pressure Distribution Systems, Elevated Sand Mounds
 - a. The use of individual septic tank systems, low pressure distribution systems and elevated sand mounds are permissible when the premises does not have access to the facilities of the County. Approval for such a system shall be obtained from the County and the Virginia Department of Health (VDH). Such installations shall be in accordance with Section 18.1-40 of the County Code. If and when public sewer becomes available, owners will be required to connect to the public sewer system.
 - b. VDH permits may be issued with any one or more of the following use conditions:

Requiring permanently installed water saving plumbing devices to reduce water flow.

Restricting the monthly water consumption of potable water to a volume based on a gallon per capita per day rate.

Restricting the occupancy of the building to a certain number of individuals.

A temporary permit may be issued for a specified time period not to exceed one year. Such permits are renewable when VDH determines there is a good cause for renewal.

- c. Before commencement of construction of such systems, the Owner shall obtain approval from the Health Department. Upon receiving such approval, the Owner shall request approval from the County Administrator. The Owner's request shall include the approved permit signed by the Health Officer plus all other supplemental information furnished to the Health Department.
- d. The County will not issue a building permit for the property until after receipt of a permit from the Health Department and issuance of a permit from the County Administrator approving the septic system, low pressure distribution system, or elevated sand mound system. A copy of the permit is provided in Appendix F.
- e. Such systems shall not be utilized until the installation is completed to the satisfaction of the Health Department. The Owner shall operate and maintain the system in a sanitary manner at all times and in accordance with Health Department requirements.

2. Septic Tank Abandonment

- a. Disconnection of a building from a septic tank system requires that the septic tank be removed and the hole filled or that the top be removed and the vault filled with an acceptable fill material. A request to the Division of Building Regulation to field verify proper septic tank abandonment is required within thirty (30) days of connecting to facilities of the County.
- b. If the abandonment of the septic system is in conjunction with connecting the building to a County sewer system the lateral being installed shall not pass through or connect to the discharge side of the abandoned septic tank.

J. Design Considerations - Grinder Pumps:

The use of grinder pump/low pressure systems shall be evaluated on a case by case basis and shall be in accordance with section 18.1-41 of the County Code. The use of grinder

pump/low pressure force main sewer systems may be authorized by the County Administrator upon a determination that one of the following conditions or circumstances exist which prevent the use of other approved means of sewage disposal.

1. Approved Commercial/ Industrial Uses:

- a. The private sewer system serving an existing commercial or industrial property has failed and can not be repaired or relocated in accordance with applicable Health Department regulations.
- b. The commercial/ industrial business submits a plan to expand their business and there is insufficient area to expand or relocate the private sewer system in accordance with applicable Health Department regulations.
- c. The property is undeveloped but was intended to be served by a grinder pump/low pressure force main system pursuant to a subdivision development plan, site plan or County sewer extension plan previously approved by York County.
- d. The County has extended service to the area and as part of the extension project, has determined that the only feasible means of serving a particular property or properties within the project area now and in the future is by use of a grinder pump/low pressure force main system.
- e. A request is made by the property owner to replace a private grinder pump system serving a commercial/ industrial property.

2. Approved Residential Uses:

- a. The private sewer system serving an existing residential property has failed and can not be repaired or relocated in accordance with applicable Health Department regulations.
- b. The property is undeveloped but was intended to be served by a grinder pump/low pressure force main system pursuant to a subdivision development plan, site plan or County sewer extension plan previously approved by York County.
- c. A gravity lateral connection has been installed to serve a lot and the topography of the land or the distance from the dwelling unit to the gravity lateral is such that it is not possible for waste water to flow by gravity from the dwelling unit to the gravity connection.
- d. A request is made by the property owner to replace a private grinder pump system serving a residential property.

- e. The County has extended service to the area and as part of the extension project, has determined that the only feasible means of serving a particular property or properties within the project area now and in the future is by use of a grinder pump/low pressure force main system.
- f. After reviewing any plans, specifications or other information provided by the owner and upon receiving written approval from the Health Department, the Director of Environmental and Development Services and the Director of Financial and Management Services have both recommended to the County Administrator that the use of the grinder pump/low pressure force main system is acceptable for the proposed use, and the County Administrator has determined that the extension is in the best interests of the health and welfare of county citizens, is in accord with the logical development of the facilities of the County, and is not being made solely to benefit the property owners. Board approval is required for extensions serving proposed subdivisions. In any case the owner may appeal the decision of the County Administrator to the Board.

3. Extensions – Commercial/Industrial:

- a. All costs shall be borne by the owner(s) of the premises to be served including the procurement of all materials and equipment and a qualified contractor for the construction and installation of the grinder pump/low pressure system and control system and electrical service.
- b. If requested by the owner of the premise the County will accept ownership of the grinder pump/low pressure system once the facilities are constructed to the standards of the County. The owner of the premise shall enter into a Public Sewer Extension Agreement (PSEA) with the County for the extension of the facilities of the County and agreeing to supply the necessary electrical power for continued operation of the system at the property owner's expense.
- c. Prior to the County accepting ownership of the grinder pump/low pressure system, the owner of the premises must convey to the County, free of charge, necessary easements for operation and maintenance of the grinder pump/low pressure force main and control system and shall pay all fees associated with conveying the easement(s) to the County, including the cost of necessary surveys.
- d. The County will own, maintain, and replace, as necessary, the grinder pump/low pressure system located within its easement. The owner will be responsible for maintaining necessary facilities outside the County's easement.

- e. If the owner of the premise elects to construct the grinder pump/low pressure system in accordance with the Health Department regulations but not to the standards of the County, the County's responsibility will begin at the clean-out valve vault assembly located on the property line.

4. Extensions - Residential

- a. All costs shall be borne by the owner(s) of the premises to be served including the procurement of all materials and equipment and a qualified contractor for the construction and installation of the grinder pump/low pressure system and control system and electrical service.
- b. The owner of the premise shall construct the grinder pump/low pressure system to the standards of the County. The owner of the of the premise shall enter into a Public Sewer Extension Agreement (PSEA) with the County for the extension of the facilities of the County and agreeing to supply the necessary electrical power for continued operation of the system at the property owner's expense.
- c. Prior to the County accepting ownership of the grinder pump/low pressure system, the owner of the premises must convey to the County, free of charge, necessary easements for operation and maintenance of the grinder pump/low pressure force main and control system and shall pay all fees associated with conveying the easement(s) to the County, including the cost of necessary surveys.
- d. The County will own, maintain, and replace, as necessary, the grinder pump/low pressure system located within its easement. The owner will be responsible for maintaining necessary facilities outside the County's easement.

5. Extensions – Subdivision of Property

- a. The County Administrator shall submit the proposed extension to the Board of supervisors for consideration along with his recommendation as soon as staff review is completed but in no event more than 60 days after receipt of a written request. County staff shall work to ensure that the property owner planning costs are kept to a minimum prior to Board consideration.
- b. If approved by the Board the extension shall be deemed to be serving an area outside of a primary service area. (The provisions of Section 18.1-65(d) and 18.1-54(c)(3) shall apply in establishing the terms of the extension agreement.)

- c. If the County will own and maintain the grinder pump/low pressure system, the extension agreement shall provide for the contribution by the developer of an amount equal to \$2,500 for each lot to be connected to the proposed system in addition to all required fees as an offset for projected increased construction inspection cost and maintenance expense over the life of the system.
- 6. When a grinder pump/low pressure force main system is proposed to serve certain areas or properties contained in a County extension project area completed after January 1, 1990, the following provisions shall apply to owners of existing parcels:
 - a. The owners of premises desiring the service as a part of the project will be required to enter a contract in recordable form with the County prior to the initiation of final engineering on the project or such other time as may be designated by the County Administrator for a particular project.
 - b. The contract will obligate the owner to pay the initial connection fee established by the County Code and to physically connect to the facilities of the County within ninety days of the Notice of Availability or such other time as may be designated by the County Administrator to the owner of the property proposed for such service.
 - c. The contract will provide for and the owner shall convey, free of charge, any necessary easements to the County for the construction, operation, and maintenance of the grinder pump/low pressure force main and control system. The cost of preparing and recording the easement plans will be paid by the County as an extension project cost.
 - d. All facilities shall meet the standards and specifications of the County and the County will construct and install the grinder pump/low pressure system on the premises within the dedicated easement as a project expense.
 - e. The County will provide the owner with the electrical cord and alarm control panel for the system. The owner will be responsible for the installation of the control panel at a location agreed to by the owner and the County and for the electrical connection from the grinder pump unit to the electrical service for the premises. The installation and electrical connection must be made by a certified electrician acceptable to the County.
 - f. To offset the cost of installing the electrical service and control panel, the owner will receive a \$400 credit against the initial connection fee. The contract will require the owner to provide electrical power for continued operation of the system.
 - g. The County will own and be responsible for maintaining and replacing the grinder pump/low pressure force main system located within its easement. The owner will be responsible for maintaining necessary facilities outside the County's easement.

When the owner of a premises contained in a County extension project area and proposed to be served by a grinder pump system chooses not to execute a contract with the County prior to the established deadline, then the provisions of paragraph 4 above shall apply to a future connection of that premises. The voluntary payment of the initial connection fee shall not relieve the owner of the premises from bearing the cost of the future installation of the grinder pump system as set out in paragraph 4.

7. Grinder pump systems which must be installed in accordance with Commonwealth of Virginia "Sewerage Regulations", Section 22.06 "Grinder Pumps" require a letter of approval from the State Department of Health before a certificate to construct can be issued. A grinder pump system needs State Department of Health approval if the system is served by a common force main, if an individual pump discharges into a pressure sewer line, or if the pump capacity at operating head is equal to or greater than 20 gallons per minute.
8. In such instances that the pump capacity is less than 20 gallons per minute, the York County Department of Environmental and Development Services technical specifications provides the minimum requirements for the grinder pump system.
9. The Division of Building Regulations must approve all grinder pump installations not requiring State Department of Health approval. The applicable standards of these sewerage regulations and/or the International Plumbing Code shall apply. .
10. All low pressure lines, cleanouts and valves maintained by York County are to be located within utility easements provided except where connecting to the main sewer. Low pressure lines placed within the Virginia Department of Transportation (VDOT) rights-of-way shall be dedicated to York County.
11. Each residence shall have an alarm installed as part of the system so as to alert the occupants of excessive high liquid levels. This includes a visual alarm installed in a conspicuous location such as a garage or kitchen.
12. Blow off valves will be required at high points in the system.
13. As a minimum, a valve box with cleanout and valve will be located at the property boundary.
14. All force mains shall discharge into a gravity system, lateral, manhole or York County force main.
15. The length of a force main between a cleanout valve box and the connection point shall not exceed 300 feet.
16. All grinder pump units shall bear the National Sanitation Foundation Seal.
17. A profile drawing is required of all force mains that are to be maintained by York County.

18. As-built drawings of the force main, in accordance with the requirements of Section IV-6, shall be submitted and approved prior to acceptance of the force main by the County.

SECTION II SYSTEM COMPONENTS

- A. General Requirements: The Contractor shall use only new materials, parts, products and equipment in the work which conforms to the specified requirements. Standards and other publications referenced in these Specifications shall be of the latest issue or revision in effect at the time of approval of the design documents, unless otherwise specified.
- B. Approval of Equipment and Materials: At the request of the Engineer, the Contractor shall supply samples of materials to be used in the work for approval by the Engineer. Unless waived by the Engineer the Contractor shall furnish a Certificate of Compliance from the manufacturer of materials and equipment used in the work stating that the material or equipment meets the requirements of this standard and specification.

Manufacturer catalogs that provide required technical, installation and descriptive data and/or samples of the precise article proposed to be furnished shall be provided to the Engineer for approval of the equipment to be supplied. Test data shall be furnished as requested by the Engineer. Prior to making performance tests, the manufacturer shall notify the Engineer sufficiently in advance so that the test can be witnessed.

Approval of shop drawings does not relieve the contractor from the responsibility of furnishing materials and equipment of proper dimension, size, quality, quantity, and all performance characteristics to efficiently perform the requirements and intent of the Contract Documents.

- C. Materials:
1. Aggregate
 - a. Bedding gravel shall be washed or crushed material which conforms to VDOT specifications for #57 coarse aggregate and ASTM C 33, or as may be approved by the Director.
 - b. Sand, when specified for backfill, shall be natural sand consisting of grains of hard, sound material free from injurious amounts of clay or other coatings and deleterious material (CBR-20 or greater unless otherwise approved).
 - c. Select stone backfill, shall conform to VDOT specifications for #25 or #26 crusher run aggregate or shall conform to VDOT specifications for #21A or #21B dense graded aggregate.

2. Casing

The casing pipe shall be either nonspiral welded or seamless steel having a minimum yield strength of 36,000 pounds per square inch and shall meet the requirements of ASTM A 53.

The carrier pipe shall be ductile iron class 52 unless otherwise approved during the design phase.

Timber skids shall be pressure treated with Pentachlorophenol to 0.6 pounds per cubic foot (ground contact) in accordance with AITC 109 Treating Standard for Structural Timber Framing. Stainless steel strapping and fasteners shall be used. Non-corrosive manufactured casing spacers may be used in lieu of timber skids when approved during the design phase.

If vent piping is required, it shall be galvanized piping. The threads shall be coated upon installation.

The casing pipe shall have the minimum wall thickness and diameters as listed in Table 2.1 (unless otherwise approved by the Director):

TABLE 2.1

Carrier Pipe Size (inches)	Casing Sizes (inches)	Wall Thickness (inches)
4	16	.250
6	18	.312
8	20	.312
10	22	.312
12	24	.375
16	28	.375
18	30	.500
20	32	.500
22	34	.500

A pipe that is to be installed under a railroad or public roadway shall meet all requirements of the permitting agent.

3. Concrete

The materials, design, mixing, placement, finishing and curing of concrete shall be in accordance with the standards, specifications and requirements of the Virginia Department of Transportation (VDOT) and American Concrete Institute (ACI).

Complete certified test reports shall be furnished to the Engineer in triplicate. The Contractor shall furnish the necessary labor, material and facilities for the making, storing, curing and testing of test cylinders. The Contractor shall notify the Engineer 24 hours prior to placing concrete and all samples must be obtained in the presence of the Engineer or his representative. The Contractor shall be responsible for all elements of the testing.

Structural concrete shall at a minimum have a 28 day compressive strength of 3,000 pounds per square inch (psi) or as otherwise approved by the Director (except concrete for precast structures which shall at a minimum have a 28 day compressive strength of 4,000 psi. Compressive strength shall be verified while construction is in progress. A minimum of four test cylinders shall be taken for each 50 cubic yards of concrete placed with no less than one set from each pour. The making, curing, storing and testing of the concrete cylinders shall be in accordance with ASTM C 31 and C 39. The testing of the cylinders is to be accomplished by an approved, competent, independent testing laboratory. One cylinder from each pour shall be tested at seven days and two cylinders from each pour shall be tested at 28 days. If either of the 28 day cylinders in a set falls below the required strength by more than ten percent, or if the average of the two falls below the required strength by more than five percent, then the forth cylinder is to be immediately tested.

The strength level of the concrete from any pour will be considered satisfactory if the average of all cylinders tested at 28 days for that pour meet or exceed the required strength, and no single 28 day cylinder is below the required strength by more than 500 psi. Any concrete which does not meet these requirements shall be removed and replaced unless otherwise deemed acceptable by the Director.

The concrete slump shall be from two to four inches unless approved otherwise by the Engineer and will be determined in accordance with ASTM C 143. Samples for slump determination will be taken from the concrete during placement in the forms. Each load of concrete shall be tested for slump.

Air content shall be between five and eight percent unless approved otherwise by the Engineer and will be determined in conformity with the requirements of "Test for Air Content of Freshly Mixed Concrete by the Pressure Method," ASTM C 231. If tests do not show satisfactory results, the mix shall be adjusted as directed.

Miscellaneous concrete in sewer construction shall at a minimum have a 28 day compressive strength of 3000 psi.

Steel reinforcement shall be grade 60 and shall meet ASTM A 615. Steel reinforcement shall be free from excessive rust or mill scale, dirt, paint, oil or other foreign substances. Bends shall be made in accordance with the requirements of the Manual of Standard Practice for Detailing Reinforced

Concrete Structures (ACI 315). Bars shall be tied at every intersection where spacing is greater than twelve inches in each direction. Where the spacing is less than twelve inches, ties shall be made at alternate intersections. The minimum concrete cover shall be provided in accordance with ACI 318.

Reinforcing steel shall be epoxy coated where shown on the plans and/or required in the specifications.

4. Masonry Work

Concrete masonry units (CMU) shall be manufacturers' standard units with nominal face dimensions of 16 inches length by eight inches height. The CMU shall be high load bearing that conforms to ASTM C 90, Grade N, Type 1.

Brick shall be best quality, machine made of clay or shale, conforming to ASTM C 216, Grade MW, Type FBS. Color and texture is to be approved by the Engineer or as specified by the Director.

Mortar materials shall be made using potable water and masonry cement conforming to ASTM C 150, Type I. The sand shall conform to ASTM C 144. Hydrated lime shall comply with ASTM C 207, Type S.

Reinforcement for composite masonry walls shall be truss design with spacing of side rods two inches less than the nominal thickness of the wall. Side rods shall be 3/16 inch diameter, cross rods shall be #9 wire. The reinforcement shall be galvanized after fabrication in accordance with ASTM A 153.

Masonry reinforcement shall be installed in the first course of block and in every second block course thereafter. Reinforcement shall lap at least six inches at splices.

5. Metals

Materials and methods shall conform to the requirements of the American Institute of Steel Construction.

6. Gravity Sewer Materials

- a. PVC Solid Wall Pipe and Fittings - Pipe and fittings shall be permanently marked with manufacturer's trademark, size, and ASTM conformance designation. Pipe and fitting sizes from four to six inch shall be SDR 23.5 or SDR 26 and shall conform to ASTM D 3034. Pipe and fitting sizes from eight through 15 inch shall be SDR 26 and shall conform to ASTM D 3034. Pipe and fittings sizes 18 inch through 27 inch shall conform to ASTM F 679. Joints shall meet all requirements of the ASTM specification referenced above for the given pipe size. Gasket materials

shall have been tested and rated as suitable for continuous contact with domestic sewage.

Joint Restraint for PVC Pipe and Fittings – retainer glands shall be EBAA Iron Series 2000PV; Uni-Flange Series 1300 or 1500; or approved equal for PVC pipe up to 12 inches in diameter. Glands shall be manufactured of ductile iron conforming to ASTM A 536. The restraining glands shall have a pressure rating equal to or greater than the pipe on which it is used. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53.

Retainer glands for PVC pipe greater than 12 inches in diameter shall be as approved by the Director.

- b. Ductile Iron Pipe - Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51 and flanged ductile iron pipe shall comply with the requirements of ANSI/AWWA C115/A21.15. The pipe shall be minimum pressure class 350.

The pipe and fittings shall have a double thickness cement-mortar lining in accordance with ANSI/AWWA C104/A21.4.

Manufacturer's standard asphaltic coating (one mil thickness) shall be provided on the exterior of all pipe and fittings. If, after installation, the exterior coating has been damaged, Contractor shall provide a two mil coating of an approved bituminous coating product to those damaged areas.

Joints shall be rubber-gasket joints of the mechanical, push-on or flanged type in accordance with ANSI/AWWA C111/A21.11 or ANSI/AWWA C115/21.15. Gasket materials shall have been tested and rated as suitable for continuous contact with domestic sewage. The minimum acceptable pressure rating for joints shall be 250 psi. Ductile iron fittings shall conform to ANSI/AWWA C153/A21.53.

Fittings shall be compact and have a minimum pressure rating of 350 psi.

Polyethylene encasement of the piping shall be provided in accordance with ANSI/AWWA C105/A21.5 were required due to soil corrosivity. Materials and methods of installation shall be in accordance with ANSI/AWWA C105; Method A, B, or C may be used unless otherwise specified. Polyethylene shall be a minimum of eight mils thick.

- c. Restrained Ductile Iron Pipe and Fittings: Joint restraint shall be provided where required by the designer and for pipelines inside casing pipes (including the first joint outside either end of the casing pipe unless that pipe section terminates in a manhole). All fittings shall have restrained joints. Restrained joint systems for piping and fittings shall be Snap-Loc/Bolt-Loc (Griffin), Super Lock (CLOW), TR Flex (U.S. Pipe) or similar systems as approved by the Engineer.

Joint Restraint for Ductile Iron Pipe and Fittings - Retainer glands shall be EBAA Iron Series 1100 ductile iron glands with thrust restraint wedges as manufactured by EBAA Iron, Inc.; "M. J. Gripper" by U. S. Pipe and Foundry; Uni-Flange Series 1300, 1390, or 1400; or approved equal. Retainer glands shall be installed in accordance with the manufacturer's recommendations and shall conform to the requirements of ANSI/AWWA C111/A21.11.

- d. Other piping systems and/or materials may be approved on a case by case basis by the Director.

7. Manholes

Manholes shall be pre-cast concrete unless otherwise approved by the Engineer. Pre-cast concrete manholes shall be manufactured in accordance with ASTM C 478 and the Standard Details. Base sections shall be the extended base type. Barrel sections for manholes up to 12 feet in depth shall have a forty-eight inch inside diameter. Manholes with a depth greater than 12 feet shall have a 60 inch inside diameter for the entire depth. Joints shall be sealed with "O"-ring rubber gaskets, "Forsheda" gaskets or butyl resin sealant in accordance with ASTM C 443, ASTM C 361, or ASTM C 381. Manholes and appurtenances shall conform to the Standard Details located in the appendix.

A maximum of two lift holes per manhole section will be permitted. Lift holes shall be filled with a non-shrink grout upon section installation. Grout shall be in accordance with VDOT Section 218.

Manhole coatings shall be as specified by the designer.

Manhole frames and covers shall conform to ASTM A 48, Class No. 30 and shall be of high quality gray cast iron that is even-grained and free from unsightly defects. Frames and covers shall be designed for AASHTO Highway Loading Class H-20. Frames and covers shall be of approved design and shall conform to the design and pattern shown on the Standard Details located in the appendix. Frames and covers shall be machined to insure a uniform bearing in all positions. Dust covers, locking covers, and watertight frames and covers shall be of approved design.

Manhole steps shall be PVC coated steel encased in a corrosion resistant, non-sparking, non-conductive material. Manhole steps shall conform to the Standard Details located in the appendix.

Pipe connections shall be made via a flexible rubber boot type connection. Flexible rubber boot pipe-to-manhole connections shall be of the locked-in factory assembled rubber ring type utilizing a stainless steel band as manufactured by Kor-N-Seal, EPCO Seal System or an approved equal.

Manhole Inverts shall be built up of brickwork and grout. Invert channels and manhole bottoms shall be shaped and smoothed with 2:1 sand-cement grout or other appropriate consistency. Precast inverts may be used if provided with a bench slope of three inches minimum vertical distance per foot of horizontal distance.

Cast-in-place base sections are permitted at straddle manholes and at other manhole locations where pre-cast bases are considered impractical upon approval by the Engineer. Cast-in-place bases shall be poured on a properly compacted foundation of a minimum six inch thick stone bedding and shall include steel reinforcing bars (one half inch diameter steel reinforcing bars spaced six inches on center both ways). The concrete shall be a minimum of 12 inches thick and shall extend eight inches outside the manhole. Proper joint construction shall be performed utilizing keyed joints, water stop, or other acceptable measures to insure that joints are leak tight.

8. Force Main Materials

Force mains four inches or larger may be either PVC or ductile iron.

- a. PVC pipe, four inches or larger, shall be unplasticized poly-vinyl-chloride (PVC) plastic pressure pipe with integral wall bell and spigot joints and shall be in accordance with AWWA C900 Class 150 DR-18. Joints shall be locked-in factory assembled rubber ring type. O-ring gaskets shall conform to ASTM F 477. Gasket materials shall have been tested and rated as suitable for continuous contact with domestic sewage.

Fittings for PVC pipe shall be ductile iron ANSI/AWWA C153/A21.53, compact fittings with a minimum pressure class of 350 psi. Manufacturer's standard asphaltic coating (one mil thickness) shall be provided on the exterior of all fittings. Fittings shall have a double thickness cement-mortar lining in accordance with ANSI A21.4 (AWWA C104). Joint restraint shall be used where specified.

Joint Restraint for PVC Pipe and Fittings – retainer glands shall be EBAA Iron Series 2000PV; Uni-Flange Series 1300 or 1500; or approved equal for PVC pipe up to 12 inches in diameter. Glands shall be manufactured of

ductile iron conforming to ASTM A 536. The restraining glands shall have a pressure rating equal to or greater than the pipe on which it is used. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53.

- b. Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51 and flanged ductile iron pipe shall comply with the requirements of ANSI/AWWA C115/A21.15. The pipe shall be minimum pressure class 350. The pipe and fittings shall have a double thickness cement-mortar lining in accordance with ANSI/AWWA C104/A21.4. Joints shall be rubber-gasket joints of the mechanical, push-on or flanged type in accordance with ANSI/AWWA C111/A21.11 or ANSI/AWWA C115/21.15. Gasket materials shall have been tested and rated as suitable for continuous contact with domestic sewage. The minimum acceptable pressure rating for joints shall be 250 psi.

Ductile iron fittings shall conform to ANSI/AWWA C153/A21.53. Fittings shall be compact and have a minimum pressure class of 350..

Joint Restraint for Ductile Iron Pipe and Fittings - Retainer glands shall be EBAA Iron Series 1100 ductile iron glands with thrust restraint wedges as manufactured by EBAA Iron, Inc.; "M. J. Gripper" by U. S. Pipe and Foundry; Uni-Flange Series 1300, 1390, or 1400; or approved equal. Retainer glands shall be installed in accordance with the manufacturer's recommendations and shall conform to the requirements of ANSI/AWWA C111/A21.11.

Manufacturer's standard asphaltic coating (one mil thickness) shall be provided on the exterior of all pipe and fittings. If, after installation, the exterior coating has been damaged, Contractor shall provide a two mil coating of an approved bituminous coating product to those damaged areas.

Polyethylene encasement of the piping shall be provided in accordance with ANSI/AWWA C105/A21.5 were required due to soil corrosivity. Materials and methods of installation shall be in accordance with ANSI/AWWA C105; Method A, B, or C may be used unless otherwise specified. Polyethylene shall be a minimum of eight mils thick.

- c. Pipe for three inch or smaller force mains shall be Schedule 80 PVC meeting ASTM D 1785 standards. Fittings shall be Schedule 80 meeting the requirements of ASTM D 2467. With the approval of the Engineer, SDR 21 PVC pipe meeting the requirements of ASTM D 2241 may be used for low pressure force mains. PVC pipe and fittings shall be

manufactured from PVC resin having a minimum cell class of 12454B or 12454C as defined in ASTM D1784. Solvent cements used for joining PVC pipe and fittings must meet the requirements of ASTM D 2564.

- d. Gate valves three inches and larger shall be resilient seat type, shall have a minimum working pressure of 150 psig conforming to AWWA Standard C509 and shall have an interior epoxy coating in accordance with AWWA C550.. The valves shall be of the non-rising bronze or stainless steel stem type with an iron body, mechanical joint or flanged ends, "O" ring stem seals, bronze mountings, and, suitable for buried service. The valves shall open left (counter-clockwise) by a two inch square operating nut. Gate valves shall be as manufactured by Darling, A.P. Smith, Mueller, Kennedy, Clow or approved equal. One valve wrench shall be provided for every three valves installed in a project.

Gate valves smaller than three inches in diameter shall be cast bronze, solid wedge disc, screwed bonnet, inside screw, non-rising stem valves with threaded connections. Valves shall conform to Standard SP80, Type 2, Class 150, Manufacturers Standardization Society of the Valve and Fitting Industry, Inc.

- e. Tapping valves shall meet the same specifications as gate valves, except they shall have a full, unobstructed opening to receive a full size shell cutter. It shall be a standard mechanical joint type on one end and a flanged joint on the other end. A Mueller H-667 or approved equal shall be used. The valves shall be subjected to a test pressure of 300 psi and be designed for a working pressure of 150 psi.

All interior ferrous surfaces of all valves shall be coated in accordance with ANSI/AWWA C550 using a coating approved by the Virginia Department of Health for contact with potable water and shall not contain lead, coal tar resins, lampblack, carbon black, or bituminous materials. The exterior surfaces shall receive a factory applied fusion bonded epoxy coating.

- f. Tapping sleeves shall be mechanical joint, cast iron, or stainless steel furnished complete with plain rubber gaskets, mechanical joint accessories, and duckback gaskets. The connecting flange between the sleeve and valve shall conform to Manufacturer's Standardization Society of the Valve and Fitting Industry Standard SP60. Stainless steel tapping sleeves, when approved, shall be JCM No. 432, or approved equal.
- g. Valve box tops shall be of cast iron construction in accordance with ASTM A 48 Class 30. Valve box frame and cover shall be in accordance with the standard details located in the appendix and shall be designed for AASHTO Highway Loading Class H-20.

9. Underground Warning Tape and Tracer Wire

Underground warning tape shall be printed polyethylene tape, magnetic, six inches minimum width, color coded, one inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types. Color coding shall be green for all sanitary sewers including force mains.

Tracer wire shall be plastic coated ten gauge, solid, copper wire. Wire coating shall be suitable for direct burial.

10. Anchor Bolts

All concrete anchor bolts not cast in place shall be stainless steel. Anchor bolts that are pre-set and cast in place may be either galvanized or stainless steel.

11. Coatings for Manhole Interiors

Coatings for manhole interiors shall be Sikagard 62, Koppers 300, or an approved equal.

12. Air Release Vents

Air release vents shall be installed where shown on the drawings and in accordance with the Standard Details located in the appendix.

13. Flowable Fill

Flowable fill shall have a design compressive strength of 30 to 200 psi at 28 days unless otherwise approved. The fluid product shall have a slump of eight inches to ten inches at time of placement.

D. Pumping Stations

Materials used in the construction of wastewater pumping stations shall meet all applicable requirements specified in this standard and specification. Any materials or equipment proposed for pumping stations shall be as specified by the designer and approved for use by the Engineer. The designer shall submit to the Engineer all documentation necessary for the evaluation and subsequent approval or rejection of the non-specified materials or equipment.

E. Vacuum Sewerage Collection Systems

1. Vacuum sewer mains and crossovers

Pipe sizes four inches and larger shall be SDR-21, PVC, rubber ring joint and shall be in accordance with ASTM D 2241. Three inch size pipe shall be all solvent weld joint and shall be either Schedule 40, PVC, in accordance with ASTM D 1785 or SDR-21, PVC, in accordance with ASTM D 2241.

All pipe fittings shall be PVC, Schedule 40 with solvent weld joints. The fittings shall be produced by Spears Manufacturing Company or an approved equal from a PVC compound having a cell classification of 12454 conforming to ASTM D 1784. All PVC fittings, with the exception of wye fittings, shall be injection molded and shall be in accordance with ASTM D 2466. Wye fittings may be fabricated on the condition that the fitting dimensions do not deviate significantly from standard fitting dimensions. If wye fittings are fabricated, the fitting sockets shall be made in accordance with ASTM D 2466.

A written certification is required for all pipe, fittings and gaskets from the manufacturer stating that: (1) the product is suitable for continuous contact with domestic sewage; (2) the product is suitable for operation in a vacuum of 24 inches mercury; and (3) that the product has been tested with air at a minimum of 24 inches of mercury vacuum with a leak rate not exceeding one percent per hour for a four hour test.

2. Interface Valves, Breathers, and Controller/Sensor

Vacuum interface valves, breathers, and controllers shall be as manufactured and supplied by AIRVAC of Rochester, Indiana. The vacuum sewage valve shall be vacuum operated on opening and spring assisted on closing. The plunger and its shaft shall be arranged to be completely out of the flow path when the valve is in its open position. The valve shall be equipped with a vacuum operator of the rolling diaphragm type and of sufficient diameter to overcome all sealing forces and open the valve fully using line vacuum pressure from the downstream side of the valve. All materials of the valve shall be chemically resistant to sewage.

The valve shall be equipped with a controller/sensor which shall rely on atmospheric air and vacuum pressure from the downstream side of the valve for its operation, thereby requiring no other power source. The controller/sensor shall be capable of maintaining the valve fully open for a fixed period of time (adjustable from 3 to 10 seconds). After the time period has elapsed, the controller/sensor shall be capable of admitting atmospheric air to the activator chamber and permitting spring assisted closing of the valve. All materials shall be chemically resistant to sewage and sewage gases and shall be capable of operating when submerged in water and/or mud.

The in-sump breather shall be as manufactured by AIRVAC.

3. Valve Pits

Valve pits shall be as manufactured and supplied by AIRVAC of Rochester, Indiana. The fiberglass pits shall be 3'-0" inside diameter at the bottoms and be conical shaped to allow fitting of a 23-1/2" diameter clear opening cast iron frame and cover. Standard valve pit depth shall be 3'-6" and Pits shall be suitable for AASHTO Highway Loading Class H-20. Each valve pit shall be supplied with an anti-flotation collar. Anti-flotation collars shall be either as supplied by the valve pit manufacturer or shall be constructed of concrete in accordance with the valve pit manufacturer's recommendations.

Frame and cover shall be designed for H-20 traffic loading. Frame shall weigh no less than 90 pounds and cover no less than 100 pounds. Lids shall be Model R 5900 F by Neenah Foundry or approved equal. The lids shall not be painted and shall be non-locking.

4. Collection Sumps

Collection sumps shall be as manufactured and supplied by AIRVAC of Rochester, Indiana. The sumps shall be made using a liquid polymer resin molding injection process, and shall be designed for H-20 loading at two feet depth of cover. Elastomer connections shall be provided for connecting the gravity line(s).

Sumps shall be either "Standard" or "Deep" and shall be either 30 inches deep or 54 inches deep, respectively, and have a capacity of 55 gallons or 100 gallons, respectively.

5. Division Valves

Valves shall be the resilient wedge gate type suitable for continuous contact with domestic sewage under both vacuum and/or pressure. Valves shall be constructed and rated for 200 psig working pressure. Wedge shall be constructed of ductile iron completely encapsulated by an elastomer of synthetic rubber. The

encapsulating material shall be resistant to domestic sewage, vegetable oils, petroleum products, soaps, and detergents. Valves shall have non-rising stems and shall be suitable for buried service. Ends shall be mechanical joint conforming to ANSI/AWWA C111/A21.11 requirements.

Valves shall be certified by an independent laboratory for a sustained operating vacuum of 24 inches mercury.

Valves shall be Waterous Company Series 500 or an approved equal.

6. Vacuum Tanks

Tanks shall be fiberglass or steel, in accordance with AIRVAC criteria, and shall be designed for a normal internal operating vacuum range of between 24.4 and 17.9 inches mercury vacuum. In addition, tanks shall be designed to withstand five psig air pressure with a five to one safety factor. Tanks shall be factory tested with air for one hour each at five psig internal pressure and 28 inches mercury vacuum internal pressure without exhibiting signs of leakage or distress. Certified factory test results are to be supplied along with the tank. Each tank shall be furnished with required number and size of nozzles, manways, lifting lugs, mounting blocks or saddles, brackets and taps. Each tank shall be supplied complete with sight glass (where required).

7. Vacuum Pumps

Vacuum pumps shall be rotary vane type, air-cooled with no water requirements, capable of continuous operations and shall have an end (ultimate) vacuum of 29.3 inches mercury. Lubrication shall be provided by an integral, fully recirculating oil supply which is filtered by an automotive-type spin-on oil filter. The pump shall be capable of operation with standard SAE 30 weight automotive grade oil. The oil separation system shall be integral and shall consist of no less than four states of internally mounted oil and smoke eliminations from the exhaust gas stream. The pump shall be of three-vane design with vanes having an average of 30,000 hours of life between replacement.

Pumps shall have a built-in anti-suck-back valve mounted at the pump inlet. Entire pump, motor, and exhaust box shall be shipped as one factory assembled and tested unit mounted on vibration isolators.

Pumps shall be supplied with a five micron inlet filter and internal exhaust filter.

Pumps shall be driven directly by a standard C-face, F2 assembly, TEFC electric motor through a shaft coupling. Belt drives shall not be permitted. Motor shall be non-overloading across the entire pump performance curve. Motor shall be suitable for operation on 240,460 Volt, 60 Hertz, 3-Phase service.

Pumps shall be manufactured by Busch, Inc. or an approved equal acceptable to both the Engineer and to AIRVAC.

8. Discharge Pumps

Each discharge pump shall be of the dry-pit, submersible type, equipped with enclosed, non-clog type, , close-grained cast iron impeller, statically and dynamically balanced, capable of passing a 3 inch diameter sphere (unless otherwise approved). Pumps should have an inspection opening in the discharge of the casing. Pump should have replaceable rotating and stationary wear rings. The pumps shall be fitted with double mechanical shaft seals. Seals suitable for abrasive applications shall be used if available. Pumps shall be equipped with seal fail and over temperature components to indicate failure situations. Pumps shall be air or media cooled; and shall be rated for continuous operation in air. Pump discharge shall contain a minimum 0.75 inch NPT tap for the connection of the vacuum equalizing line. Pumps shall be manufactured by Flygt, Fairbanks Morse, Cornell or an approved equal acceptable to both the Engineer and to AIRVAC.

Motor – Each pump shall be driven by a completely sealed and jacketed, electric submersible squirrel caged induction motor of 1.15 service factor, 460 Volt, 60 Hertz, 3-phase power. The motor nameplate horsepower shall not be exceeded by the brake horsepower requirements of the specified head and capacity conditions. The motor shall be non-overloading across the entire range of the pump curve. Submersible motor shall be UL listed for Class I, Division I, Group C and D explosion proof hazardous locations. The motor cable, installed, shall be suitable for submersible pump applications with NEC approval. Motors shall be rated for continuous operation in air and shall be cooled by the circulation of a cooling liquid in a closed loop through a jacket.

9. Collection Station Piping

Except where otherwise authorized by the Engineer, wastewater, vacuum and drain lines larger than four inch diameter shall be flanged ductile iron. Ductile iron pipe and fittings shall meet the requirements specified for force mains.

Vacuum lines as well as other lines under four inch diameter (other than equalization lines) shall be Schedule 80 PVC meeting ASTM D 1785 standards. Fittings shall be Schedule 80 meeting the requirements of ASTM D 2467. PVC pipe and fittings shall be manufactured from PVC resin having a minimum cell class of 12454B or 12454C as defined in ASTM D 1784. Solvent cements used for joining PVC pipe and fittings must meet the requirements of ASTM D 2564.

Black Iron Pipe meeting ASTM A 106 requirements shall be used for exhaust lines off of the generator and for the heat effected segment of the exhaust lines off of the vacuum pumps.

Equalization lines shall be clear polyvinyl chloride (PVC) meeting ASTM D 1785, Schedule 40 unless otherwise approved. Fittings shall be socket type and meet ASTM D 2466, Schedule 40, unless otherwise approved. Solvent cement shall meet ASTM D 2564.

Building sanitary drains shall be PVC DWV pipe and fittings.

Copper water pipe shall be seamless copper tubing conforming to ASTM B 88, Type K, Temper 060, and shall be of the coiled type. Fittings shall be wrought copper solder-joint pressure fittings conforming to ANSI B16.22. Copper tube and fittings shall be rated for a working pressure of 100 psi. Joints shall be compression style.

Piping shall be supported by adequate pipe support systems designed in accordance with recognized engineering practices to prevent sagging and vibration and to permit expansion, venting and drainage. Pipe hangers and supports shall conform to the requirements of ANSI B31.1.

10. Check Valves

Valves smaller than three inches in size shall be Class 125 of solid bronze construction conforming to ASTM B 61 and ASTM B 62. Valves shall be of the Y pattern horizontal swing check type with screwed cap. The disk shall be solid bronze and shall be renewable. Valves shall be Nibco Inc., 125 lb swp bronze check or approved equal.

Valves three inches and larger shall be designed for a minimum working pressure of 150 psi and shall be iron body, bronze mounted, full opening swing check type with bolted cover, stainless steel hinge and malleable iron clapper arm. The disk shall be cast iron with a bronze seat ring. Valves shall be furnished with an outside lever and weight (valves ten inches and larger shall have an outside lever and spring). Valves shall be manufactured by Val-matic, M&H Valve Company, Clow Corporation, Mueller Company or approved equal.

11. Plug Valves

Plug valves shall be the eccentric seating type suitable for service in sewage under both negative and positive pressure conditions. Valves shall be constructed and rated in accordance with ANSI Specifications B16.1 Class 125. Valves shall be capable of sustaining a vacuum of 24 inches mercury and each valve shall be tested and certified to two and nine-tenths pounds pressure absolute.

Valves shall be designed with round ports capable of passing a hard solid sphere with an outside diameter equal to not less than 85% of the nominal valve size without interference from the closure element.

Valves four inches and smaller shall be direct actuated; valves larger than four inches shall be gear driven.

Valves shall be Milliken Valve Co. Model 600 Series, Millcentric Series, or approved equal.

12. Motor Control Center

The motor control center shall be manufactured, assembled, wired, and tested by the factory in accordance with NEMA Publication ISC2, Part ISC2-322, for Industrial Controls and Systems. The vertical section and the individual units shall bear a UL label, where applicable, as evidence of compliance with UL Standard 845.

All wiring and components of the motor control center shall be in accordance with applicable sections of NEMA and the National Electrical Code and shall be in accordance with the AIRVAC Design Manual.

F. Private Wastewater Disposal Systems:

Materials for private wastewater disposal systems shall be in accordance with the requirements of the Commonwealth of Virginia, State Board of Health, "Sewage Handling & Disposal Regulations."

G. Grinder Pumps:

Materials for grinder pumps shall be in accordance with the Commonwealth of Virginia "Sewerage Regulations," Section 22.06 and shall satisfy all requirements of the York County Division of Building Regulation. Materials for force mains shall be as specified above for force mains.

Grinder pumps shall be of the semi-positive displacement type as manufactured by Environment One or approved equal.

SECTION III CONSTRUCTION METHODS AND TESTING

A. General Requirements:

1. Erosion and sediment control/land disturbing activity permit:

- a. No person shall engage in any regulated land disturbing activity until he has submitted an erosion and sediment control plan for approval and has received a permit certifying such approval has been issued in accordance with Chapter 10 of the York County Code.
- b. No agency, department or officer authorized under any other ordinance or law to issue grading, building or other required permits for projects involving land disturbing activities shall issue such permits until the following requirements are met:
 - i. The Erosion and Sediment Control/Land Disturbing Activity Permit has been issued.
 - ii. An initial inspection of the erosion and sediment control measures for the project has been conducted.
 - iii. Notification has been issued that the project is in compliance with the erosion and sediment control plan.

2. Certificate to Construct

Before a Contractor begins work, an application for a Certificate to Construct shall be submitted to the Department of Environmental and Development Services. A sample copy of the certificate is located in Appendix A. Work shall not commence until the County issues the Certificate to Construct, and the Developer/Contractor has acquired a Land Disturbing Permit for the project.

3. Clearing

Clearing shall be confined to within the limits identified on the approved erosion and sediment control plan. Any damage outside of these limits that result from the Contractor's operations shall be the Contractor's responsibility.

4. Grubbing

Areas to be grubbed shall have roots or other objectionable materials and debris removed to a minimum depth of 12 inches below ground surface. All stumps shall be removed regardless of their depth from ground surface. Where grubbing is not required stumps shall be ground up or cut flush with the ground.

5. Disposal

All unsuitable materials and debris resulting from the Contractor's operation shall be disposed of legally by the Contractor.

6. Restoration/Replacement

Trees and shrubs damaged, but remaining, shall be repaired in accordance with the guidelines established by the Virginia Cooperative Extension Agency and the "Virginia Erosion and Sediment Control Manual", latest edition. Trees and shrubs intended to remain but which have been damaged beyond repair, or which have been removed, shall be replaced by the Contractor.

The Contractor shall protect existing trees and shrubs to remain in place against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within the drip line.

- a. Trees to remain shall be identified by flagging, a 48 inch high snow fence or comparable barrier.
- b. Roots of trees to remain shall be protected from damage.
- c. Where possible, roots in the trench line over 1.5 inch in diameter shall be tunneled by hand with the pipe laid below the roots.
- d. Exposed roots are to be temporarily covered with exposed wet burlap to prevent roots from drying out; these roots are to be covered with earth as soon as possible. Roots, which can not be avoided, shall be cleanly cut with a root pruner.
- f. The faces of roots over 1.5 inch in diameter cut during construction operations shall be coated with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues.
- g. Trenches within the root area of trees to remain shall be backfilled to finished grade with one part peat moss and three parts topsoil. The area shall be watered at the time of backfill. The trenches shall be fertilized with 30-10-7 slow-release organic nitrogen fertilizer to stimulate root growth.

7. Topsoil Removal and Restoration

The following procedure shall be followed for topsoil removal and replacement:

- a. Strip topsoil;
- b. Stock topsoil in location shown on plans;
- c. Perform the work;
- d. Scarify subsoil at least four inches in depth;
- e. Spread topsoil to preconstruction grades;
- f. Remove all objects over two inches in diameter; and
- g. Landscape per approved plan.

8. VDOT Tree Trimming Permit

Before the Contractor trims or clears any trees on a Virginia Department of Transportation (VDOT) right-of-way, the Contractor shall obtain a Tree Trimming Permit from VDOT. One copy shall be provided to the Inspector.

9. Burning Permits

Prior to burning construction debris the Contractor shall obtain required burning permits from local and state jurisdictions. The Contractor shall provide one copy to the York County Inspector and post and maintain one copy on-site.

10. Property Corners

Property corners and survey monuments shall be preserved during construction activities. If a property corner or survey monument is disturbed or destroyed during construction, whether by accident, careless work, or required to be disturbed or destroyed by the construction work, said property corner or survey monument shall be replaced by a land surveyor registered in the State of Virginia. All costs to be paid by the Contractor unless other agreements have been made.

11. Stabilization and Maintenance

Areas utilized by the Contractor during the construction activities shall be cleaned to the satisfaction of the Engineer and Owner. All lumber, earth clods and rocks larger than two inches in diameter, or other undesirable materials shall be reduced in size or removed from the site and legally disposed of by the Contractor.

The Contractor shall return all areas disturbed during the course of construction to a condition equal to or better than those existing prior to the commencement of construction.

All disturbed areas not designed for pavement and sidewalk replacement or structural use shall be stabilized. Stabilization shall include topsoil, seed, fertilizer, lime, and mulch applied in accordance with the latest edition of the "Virginia Erosion and Sediment Control Manual."

Disposal of excess materials, cleanup activities, site restoration and stabilization shall be accomplished within seven days of the trench excavation.

Trees, shrubs and ground cover shall be maintained by the Contractor until final acceptance but in no case less than 60 days after planting. All plantings shall be guaranteed for a period of one year pending final acceptance.

From time to time as work progresses the Contractor shall clean up and dispose of off-site, all refuse and unused materials of any kind resulting from the work. Upon failure by the Contractor to do so within 24 hours after directed, the work may be done by the County and the cost of the clean-up charged to the Contractor.

12. Location of Sewers in Relation to Streams, Estuaries, Lakes, and Reservoirs

The tops of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the streambed to protect the sewer line. In general, one foot of suitable cover shall be provided where the stream is located in rock and three feet of suitable cover in other material. Less cover will be considered if the proposed sewer crossing is encased in concrete and will not interfere with future improvements to the stream channel. In paved channels, the top of the sewer lines shall be placed below the bottom of channel pavement. Sewers shall be designed to remain fully operational during the 25-year flood/wave action. Sewers and their appurtenances located along streams shall be protected against the normal range of high and low water conditions, including the 100-year flood/wave action. Sewers located along streams shall be located outside of the streambed whenever possible and sufficiently removed therefrom to provide for possible future channel widening.

13. Sewers Crossing Streams, Estuaries, Lakes, and Reservoirs

Sewers entering or crossing the above referenced waterways shall be constructed of watertight pipe. The pipe and joints shall be tested in place, shall exhibit "zero" infiltration, and shall be designed, constructed and protected against anticipated hydraulic and physical, longitudinal, vertical and horizontal loads, erosion and impact. Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that no other practical alternative exists. Such sewers on piers shall be constructed in accordance with the requirements for sewers entering or crossing under streams (see Standard Details located in the appendix). Construction methods and materials of construction shall be such that sewers will remain watertight and free from change in alignment or grade. Any trees subject to dying, which will cause damage to the

structure or environment should it fall, shall be removed by the Contractor or developer.

B. Excavation, Backfill, Bedding and Compaction:

1. Dewatering

Excavations shall be kept free from standing water during pipe installation, and to such extent as may be necessary during backfilling. This includes lowering the water table below trench bottom by well points and/or pumping with pumps of sufficient capacity to dewater the excavations.

Disposal of excess water shall not affect public health or cause injury or damage to public or private property, the work of other Contractors, or to any portion of the work completed, or in progress, or cause impediment to the use of highways or streets by the public. Dewatering flows shall be controlled in accordance with the erosion and sediment control regulations. Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device or both and discharged in a manner that does not adversely affect flowing streams or offsite property. Upon completion of dewatering, the removal of sediment from storm sewers and drainage ditches and restoration of the impoundment area is required.

Gutters, storm sewers, drains and ditches shall be kept open at all times. No damming or ponding of water in gutters or other waterways will be permitted.

2. Excavation

All work shall be performed to dimensions and depths shown on the approved Plans. Material suitable for backfill shall be stockpiled near the site. Materials undesirable for backfill shall be legally disposed of off-site.

Existing utilities, structures and fencing shall be protected during the construction period, and if damaged or removed during operations, shall be repaired or replaced in as good or better condition.

Where an excavation is deeper than necessary a layer of consolidated gravel (No. 57 course aggregate or equal) shall be placed in sufficient quantity to allow the pipe to be placed at the proper elevation.

Excavated material shall be stockpiled so as not to interfere with public travel. Bridging shall be provided as necessary to provide access to public or private property.

During the progress of the work, sidewalks, crossings and driveways shall be kept open for the passage of pedestrians and vehicles. Permission and authorization

shall be obtained for partial or complete closing of a street, driveway or crossing. Perform all work impacting traffic flow or public rights-of-way in accordance with VDOT standards and requirements.

3. Trenching

Pipe installation operations shall be kept as close to the excavation as possible. As a general rule no more than 200 feet of trench is to be opened at any time. The York County Inspector reserves the right to stop the excavation at any time if and when, in his opinion, the trench is opened too far in advance of pipe installation. Trench excavations shall conform with all Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees.

Unless otherwise shown on the plans pipe trenches shall be excavated to a depth that will insure a minimum of 36 inches of cover for gravity sewer lines. Lines with less than 36 inches of cover shall be ductile iron. Pipe for gravity sewer lines shall be laid to the alignment, grades and limits shown on the drawings. Trenches shall be limited to sufficient width to provide a free working space on each side of the pipe for properly placing and joining the pipe and placing and compacting the bedding and backfill materials. The excavation shall take into account the pipe bells and shall be of sufficient depth to permit access to the joint for construction and inspection.

4. Bedding

Type III Bedding, as shown in the Standard Details (located in the appendix), shall be provided under all flexible piping (i.e. PVC and other forms of non-rigid piping). Aggregate bedding shall not be required when ductile iron pipe is installed unless specified by the design engineer or necessitated by poor bearing conditions of the native soils. Bedding material shall be used for laying ductile iron pipe when needed to provide a suitable foundation. Additional bedding, such as Type IV Bedding, shall be used when local conditions require additional pipe support.

Manholes shall be bedded with a minimum of six inches of bedding material in accordance with the Standard Details (located in the appendix).

Laterals shall be installed with Class III bedding up to and including the cleanout stack.

Unstable foundations may be improved with geotextile materials in lieu of extra cut and fill and the use of select material. The use of geotextile materials and the location of their use shall be shown on a plan and approved by the Engineer on a case by case basis. Installation if approved shall be in accordance with manufacturer's requirements.

5. Backfill and Compaction

All pipe shall have proper bedding and each joint properly made before backfill is placed. All trenches shall be backfilled with approved material immediately after the pipes are laid, unless other protection of the pipe line is provided and approved by the Engineer. Where trench excavation material is deemed suitable and the use of select material has not been required, the trench excavation material shall be used for backfill. Where trench excavation material is deemed unsuitable for backfilling, the Contractor shall provide select backfill consisting of clean earth, sand, gravel, or other approved material. The determination of suitability of all backfill shall be made by the Engineer. The quantity and source documentation shall be provided upon request.

Backfill material shall be carefully tamped around and over the pipes in six inch layers up to a level at least one foot above the top of the pipe. The maximum size stone in the first 12 inches of backfill shall not exceed one inch in diameter. Simultaneous backfilling on both sides of the pipe is required. The remainder of the backfill shall be deposited and compacted by mechanical equipment in thoroughly tamped layers not exceeding one foot lifts. The maximum size stone permitted in this portion of backfill shall not exceed two inches diameter. In areas where paving is to be placed over the backfilled trench, the entire depth of backfill shall be deposited in six inch layers and compacted by hand or mechanical tampers. Flooding with water to achieve compaction is not permitted.

Backfill compaction requirements shall be in accordance with AASHTO Method T-99, modified. Each layer of material is to be compacted to a minimum of 95 percent of the maximum density at optimum moisture content as described by ASTM D 698, (85 percent is acceptable in yard and non-paved areas).

Compaction Testing

- a. Conduct compaction testing at locations approved by the Engineer during backfilling operations.
- b. Determine compaction by the testing procedure contained in ASTM D1556.

It is the intent of this Specification to secure a condition where no further settlement of trenches will occur so that when backfilling is completed the roadway or base or final ground cover may be placed immediately. Additionally, settlement is not to occur around manhole structures.

When using mechanical tampers the Contractor shall exercise care to insure that pipe joints will not be broken, damaged or disturbed.

The trench shall be maintained in a dewatered state during placing of backfill and while compacting. Sufficient water shall be added to fill material, as required, to allow proper compaction.

Testing - Compaction tests of in-place trench material shall be performed to assure attainment of required density. These tests shall be made at the Contractor's expense and utilize a Soils Laboratory approved by the Engineer. Generally, one test is to be performed per 1200 linear feet of pipeline for every 24 inches of lift required starting from one foot above the pipe. The Contractor shall give copies of all test results in a report form to the County Inspector to demonstrate compliance with compaction requirements. The number of required tests shall not be construed as to be limited to one test per 1200 linear feet. If additional testing or alternative test methods are required by other agencies involved in the project, such as VDOT, it shall be the Contractor's responsibility to satisfy all additional requirements.

The Contractor shall repair any settlement within the one year guarantee period. The Contractor shall make all necessary repairs and replacements within 30 days after notice from the Engineer.

6. Sheeting, Shoring and Trench Boxes

All excavations and other work requiring sheeting, shoring or trench boxes shall be performed in accordance with all Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees. The Contractor is solely responsible for the safety and condition of all work. The contractor shall not proceed until the necessary trench boxes, sheeting, shoring and bracing have been properly installed. Shoring shall not be removed before a minimum of two feet of backfill has been placed over the crown of the pipe and compacted to the required density. The Contractor shall, at his own expense, protect from direct or indirect injury all personnel, pipes, tracks, walls, buildings, and other structures of property in the vicinity of his work, whether above or below the ground.

All sheeting, shoring and bracing shall be removed by the Contractor during backfilling operations unless otherwise approved by the Engineer.

7. Unstable Subgrade

In the event that unsuitable material is encountered at or below the level of the pipe bed, such material shall be removed and replaced, or removed, stabilized and replaced. Material used for replacement must be No. 57 course aggregate or other material specifically designated in writing by the Contractor's engineer and approved by the Engineer.

8. Overhead high voltage lines safety act

The Contractor shall comply with the provisions and requirements of the Overhead High Voltage Lines Safety Act (Section 59.1-406, ET. SEQ. Of the Code of Virginia) in performing work. As a minimum, the Contractor shall:

- a. Contact the electric utility 48 hours prior to commencing work if the contractor's tools or materials will intrude within six feet of an overhead power line.
- b. Contact the electric utility 48 hours prior to commencing work if covered equipment such as cranes or derricks will be operated within ten feet of an overhead power line.
- c. Post and maintain warning signs within and on the outside of equipment operation near an overhead high voltage line.

C. Pipe Installation - Gravity Lines:

Each joint of pipe shall be inspected for defects prior to being lowered into the trench. The pipe shall be swabbed or brushed out to insure that dirt or foreign materials do not get into the finished line. Trench water shall be kept out of the pipe and the pipe kept closed by means of a plug whenever work is not in progress. Bell and spigot pipe laying shall proceed upgrade with spigot ends pointing in direction of flow.

Pipe installation shall commence immediately after the excavation is started, and every means must be used to keep pipe laying close behind trenching. Holes shall be scooped out for the bells and the entire barrel of the pipe shall bear on the pipe bed. An engineering grade level shall be maintained on site to check pipe grade with project benchmarks. This is required for each run of pipe. Engineer grade stakes shall be placed and maintained at every manhole location site.

Care shall be taken that the pipe is laid accurately to line and grade. The pipe shall lie on a straight sight line between manholes without dips or bends. Any section of pipe found to be laid at the wrong grade, or to have settled shall be dug up and re-laid at the Contractor's expense.

A laser shall be used to maintain line and grade. A ventilating fan shall be used in conjunction with the laser beam to preclude fumes or air conditions which may cause refraction. A copy of the certification of the laser calibration shall be provided for each separate job prior to the beginning of pipe installation.

Pipes shall be handled carefully as they are lowered into the trench. Proper and suitable equipment and tools shall be used for the safe and convenient handling of pipe during installation. Special care shall be taken to insure that each length abuts against the next in a manner which precludes shoulder unevenness of any kind. A pipe joint shall not be brought into position until the preceding length has been secured in place with sufficient backfill material to prevent movement of the pipeline.

Whenever a pipe requires cutting to fit into the line or to bring it to the required location, the work shall be done so as to leave the end smooth. A rigid coupling shall be installed to maintain interior pipe alignment.

Ductile iron pipe shall be required for installation of pipe with less than three feet of cover or at a depth exceeding 15 feet. A minimum 10 foot section of ductile iron pipe shall be used to tie into an existing manhole.

Clean out assemblies shall be constructed as follows unless otherwise approved by the Engineer. All joints from the first 45 degree elbow (where the lateral begins to turn to the vertical) to the termination of the vertical section shall be solvent weld glue joints. The vertical riser shall be terminated with a glue cap. For existing homes, the pipe cap shall be within four inches of the top of the cleanout casting and the casting shall be set to finished grade. In areas under development or other situations where the cleanout assembly is subject to being damaged by continuing construction activities the clean-out assembly shall be set as follows. The vertical section shall be terminated three feet below grade with the glue cap. The cleanout casting shall be placed a few inches above the cap and the entire assembly buried to protect it from further construction. A marker post (metal fence post or treated four-by-four post) shall be set to identify the cleanout. It is the Contractor's responsibility to insure that the County Inspector has obtained adequate as-built documentation of the location of the cleanout prior to backfilling over the assembly.

D. Pipe Testing - Gravity Lines:

Infiltration/inflow shall not exceed 100 gallons per day per mile of sewer per inch of pipe diameter, not including an allowance for manholes (This equates to 1.89 gallons per day per 100 feet of sewer per inch of pipe diameter) and there shall be no visible leaks in the lines or manholes. Low pressure air testing of all gravity lines shall be performed in accordance with ASTM F 1417.

Prerequisites - Prior to scheduling tests for the new sanitary sewer, the following must be addressed:

- a. A minimum of 30 days must have elapsed since installation of the sanitary sewer lines.
- b. Preliminary certified "as-builts" must be submitted to and approved by the appropriate County personnel.
- c. All essential underground utilities (water, electric, telephone, gas and cable) must be installed or a plan shall be submitted mitigating conflicts from future utility installations.

New gravity sanitary sewer systems will be tested as follows: (1) Deflection Test; (2) Low Pressure Air Test; (3) Visual Test and (4) Closed Circuit Television Camera (TV)

inspection. Testing and inspection shall be conducted in the order given and the gravity section must pass each test before moving to the next test. A field test worksheet/inspection report is provided in Appendix B.

The Engineer or York County Inspector shall be notified 48 hours prior to all tests. Representatives of the developer or developer's engineer may be present. All testing activities require compliance with the Occupational Safety and Health Agency (OSHA) in regard to confined space entry.

Responsibilities - The Contractor shall furnish all the necessary tools, equipment, and labor and be responsible for conducting all low-pressure air tests. The County will supply the Mandrels for the deflection testing and will be responsible for the initial TV inspection (including furnishing the equipment and labor) for each gravity line. A York County Inspector shall witness all low-pressure air tests and verify the accuracy and acceptability of the test and the equipment utilized. The Contractor is responsible for any repair work on sections that do not meet testing requirements and for any TV inspections required beyond the initial one.

1. Deflection Test - The entire length of all flexible gravity sanitary sewer lines shall be tested by means of a rigid mandrel to assure that deformation or deflection does not exceed five percent of the base inside diameter (as defined in ASTM D 3034 and ASTM F 679) of the pipe. A mandrel will be pulled through the line in the presence of a County Inspector. The mandrel, one for each size of pipe, shall be a nine arm mandrel, with a proving ring sized at 95 percent of the base inside diameter of the pipe. Lines must be free of debris for this test and the Contractor shall be responsible for installing a stringline in the pipe for the test. The deflection test shall not be performed until a minimum of 30 days after installation of the line to be tested. Any sections that do not pass shall be corrected or replaced by the Contractor. Ductile iron pipe will not be required to have a deflection test performed. Refer to Table 3.1 for the mandrel sizes used for deflection tests.

TABLE 3.1

York County Mandrel Standard
Based upon ASTM D 3034 and ASTM F 679

Pipe Type	Nominal Pipe Size	Average Inside Diameter	Mandrel Size (5% Deflection)
PVC ASTM D 3034 SDR 23.5	6	5.71	5.28
PVC ASTM D 3034 SDR 26	8	7.71	7.11
	10	9.64	8.87
	12	11.48	10.55
	15	14.05	12.90
PVC ASTM F 679	18	17.56	16.13
	21	20.70	19.00
	24	23.30	21.36
	27	26.26	24.06

2. Low-Air Pressure Test - An air test conforming to ASTM Specification F 1417 or an equivalent standard as approved by the Engineer, will be performed. The Contractor is responsible for supplying an air-testing rig and pressure gauge, calibrated to the tenth of a pound, for this test.

Safety - All plugs must be installed and properly inflated to prevent blowout. All pressurizing equipment used for low-pressure air testing shall include a regulator or relief valves set no higher than nine pounds per square inch gauge to avoid over-pressurizing and displacing temporary or permanent plugs. No person shall enter a manhole while air is being forced into a pipe with plugs in place or when any pressure remains behind plugs.

Equipment - All plugs shall be capable of resisting internal testing pressures without the aid of external bracing or blocking. If pneumatic plugs are utilized, a separate hose is required to inflate the pneumatic plugs from the above ground control panel. To facilitate test verification by the Inspector, all air used shall pass through a single above ground control panel. The above ground air control equipment shall include a shut-off valve, pressure regulating valve, pressure relief valve, input pressure gauge, and a continuous monitoring pressure gauge having a pressure range from zero to at least ten psig. The gauge dial shall be divided in 0.1 psi or smaller increments. The gauge shall have an accuracy of plus or minus 0.04 psi. Two separate hoses shall be used (in addition to hose for pneumatic plugs) to: (1) connect the control panel to the sealed line for introducing low-

pressure air, and (2) a separate hose connection for constant monitoring of air pressure build up in the line.

Line Preparation (Laterals, Stubs and Fittings) - All service laterals, cleanouts, stubs, and fittings within the sewer test section shall be properly capped or plugged during construction to prevent air loss that could cause an erroneous air test result.

Air-Test Procedure (Refer to ASTM F 1417 for complete procedure)

- a. Plug Installation - After a manhole-to-manhole reach of pipe has been backfilled to final grade and prepared for testing, the plugs shall be placed in the line at each manhole and secured. Once the plugs are in place and the air hoses connected, the plugs are inflated. After all lines are plugged, the sewer line can be pressurized to the test pressure.
- b. Line Pressurization - Air shall be supplied slowly to the section of the sewer being tested until the internal pressure reaches 4.0 psig greater than the average back pressure of groundwater above the pipe, but not greater than 9.0 psig. The groundwater adjustment shall be calculated by dividing the average vertical height (in feet) of groundwater above the invert of the sewer pipe to be tested, by 2.31. The result gives the adjustment in pounds per square inch that must be added. If this results in a required test pressure of above 9.0 psig, then the Contractor must lower the elevation of the groundwater surrounding the pipe to a point that will result in a required test pressure of 9.0 psig or less.
- c. Pressure Stabilization - After an internal pressure of 4.0 psig (plus required groundwater adjustment) is obtained, allow at least two minutes for air temperature to stabilize.
- d. Timing Pressure Loss - After two minutes, the air hose from the control panel to the air supply shall be shut off and disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased by no more than 0.5 psig. At a reading of 3.5 psig (plus required groundwater adjustment), timing shall commence. The watch or timing device shall be stopped and read when the pressure drops 1.0 psig and the elapsed time (in minutes and seconds) shall be recorded.

Acceptance of Air Testing

If the time shown in Table 3.2 (or calculated from the formulas contained in ASTM F 1417) for the designated pipe size and length elapses before the air pressure drops 1.0 psig, the section undergoing test shall have passed and shall be presumed to be free of defects. If the section fails to meet these requirements, the Contractor shall determine at his own expense the source or sources of leakage,

and shall repair or replace all defective materials and/or workmanship to the satisfaction of the Inspector. The completed pipe installation shall then be retested until the requirements of this test are met.

TABLE 3.2
AIR TEST TABLE (Based on Equations from ASTM F 1417)

SPECIFICATION TIME (min:sec) REQUIRED FOR PRESSURE DROP FROM 3 1/2
TO 2 1/2 PSI WHEN TESTING ONE PIPE DIAMETER ONLY

LINE LENGTH (FEET)	PIPE DIAMETER (INCHES)								
	4	6	8	10	12	15	18	21	24
25	3:46	5:40	7:34	9:26	11:20	14:10	17:00	19:50	22:40
50	3:46	5:40	7:34	9:26	11:20	14:10	17:00	19:50	22:40
75	3:46	5:40	7:34	9:26	11:20	14:10	17:00	19:50	22:40
100	3:46	5:40	7:34	9:26	11:20	14:10	17:00	19:50	22:40
125	3:46	5:40	7:34	9:26	11:20	14:10	17:00	21:13	26:51
150	3:46	5:40	7:34	9:26	11:20	14:10	18:19	25:27	32:13
175	3:46	5:40	7:34	9:26	11:20	14:34	21:22	29:22	37:35
200	3:46	5:40	7:34	9:26	11:20	16:39	24:25	33:56	42:57
225	3:46	5:40	7:34	9:26	12:31	18:44	27:28	38:11	48:19
250	3:46	5:40	7:34	9:49	13:54	20:49	30:31	42:25	53:41
275	3:46	5:40	7:34	10:47	15:17	22:54	33:34	46:40	59:04
300	3:46	5:40	7:36	11:46	16:41	24:59	36:37	50:54	64:26
350	3:46	5:40	8:47	13:44	17:48	29:08	42:44	59:23	75:10
400	3:46	5:40	10:03	15:42	22:15	33:18	48:50	67:52	85:54
450	3:46	6:18	11:18	17:39	25:01	37:40	54:56	76:21	96:39
500	3:46	7:00	12:33	19:37	27:48	41:38	61:02	84:50	107:23

- NOTES:
- a) The County of York requires a minimum test pressure of 4.0 psig with no more than 1.0 psig pressure loss for the above duration of times listed.
 - b) Test pressures shall increase according to groundwater levels over the sewer line.
 - c) Maximum pressure shall be no higher than 9.0 psi.

3. Visual Test - All manhole lids shall be removed by the Contractor as a prerequisite to conducting the visual test. The Contractor shall certify that all manhole entries are in compliance with confined space entry procedures and mechanical ventilation shall be provided.

A visual inspection shall consist of the following:

- a. Inspection for visible leaks in lines or manholes.
 - b. Condition of the grout in the interior joints or manholes.
 - c. Inspection of manhole frames and covers for proper type and installation.
 - d. Inspection to see if lines are free of debris.
 - e. Spot check of pipe grades compared to "as-builts."
 - f. Check of alignment and grade by flushing with water and observing with reflected sunlight.
4. Closed Circuit Television (TV) Inspection. Upon successful completion of the other three test procedures, the Contractor shall arrange for a TV inspection with the County Inspector. Under normal circumstances the TV inspection will be performed within one week of the request. The County shall accept the responsibility of the initial TV inspection only. If the lines have not been thoroughly cleaned, repairs are necessitated, etc a subsequent TV inspection will be required. For any subsequent inspections, it shall be the responsibility of the Contractor to obtain the services of a private TV inspection company. A tape copy of the inspection shall be given to the County for review. The Contractor shall be responsible for repeating the TV inspections as necessary until the sewer is accepted by the County.

E. Pipe Installation - Force Mains:

Each joint of pipe shall be inspected for defects prior to being lowered into the trench. The pipe shall be swabbed or brushed out to insure that dirt or foreign materials do not get into the finished line. Trench water shall be kept out of the pipe and the pipe kept closed by means of a plug whenever work is not in progress. The pipe shall be handled carefully and in accordance with the manufacturer's instructions and recommendations. Bell and spigot pipe shall be laid with spigot ends pointing in direction of flow.

Pipe installation shall commence immediately after the excavation is started, and every means must be used to keep pipe laying closely behind the trenching. Type III bedding, as a minimum, is required for flexible pipe. Additional bedding may be required, such as Type II for ductile iron pipe or Type IV for flexible pipe, depending upon soil conditions.

Proper and suitable equipment and tools shall be used for the safe and convenient handling of pipe during installation. Special care shall be taken to insure that each length abuts the next in a manner that precludes shoulder unevenness of any kind. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded the full length of its barrel. A pipe joint shall not be brought into position

until the preceding length has been secured in place with sufficient backfill material to prevent movement of the pipeline.

Whenever a pipe requires cutting for the insertion of valves, fittings, closure pieces, or to bring it to the required location, the work shall be performed so as to leave the end smooth in accordance with the manufacturer's instructions or recommendations. A pipe damaged by the Contractor in cutting shall be replaced at his expense.

All pipe laying and joining shall be performed in strict accordance with manufacturer's installation instructions.

Magnetic Detection - All pressurized underground utility lines shall have installed a continuous strip of identification tape within 18 inches of the ground surface; located over the centerline of the pipeline. PVC pipe shall have in addition to the tape a plastic coated ten gauge solid copper clad wire attached to the pipe with plastic strapping. The wire shall terminate above ground at a minimum of every 500 feet for connection to a conductive metal detector. A valve box shall be used to house the ends of the wire.

Thrust Restraint - All pipe fittings, bends, tees, and valves shall be properly restrained to resist thrust. Thrust restraint shall be designed utilizing standard engineering practice to meet the requirements of each installation considering parameters such as the pipe size, pressure, and soil conditions. A plan detailing the location and design of the pipe restraint shall be submitted to the Engineer for approval. All exposed piping, flanges, couplings, tie rods, nuts and bolts shall be given two coats of Koppers Bitumastic 50, or approved equal protective coating. Restrained joint PVC (utilizing megalugs or uniflanges) may be approved by the Director for specific installations.

Restrained Pipeline - All restrained pipeline shall be ductile iron pipe with ductile iron retainer glands equipped with set screws in accordance with AWWA C 111 and manufacturer's standards. Restrained pipeline shall be installed where required by the designer. All exposed piping, flanges, couplings, tie rods, nuts and bolts shall be given two coats of Koppers Bitumastic 50, or approved equal protective coating.

F. Pipe Testing - Force Mains:

All completed pressure lines and appurtenances shall be pressure tested by the Contractor in the presence of the Engineer or his authorized representative in accordance with the following procedure.

The Contractor shall provide the water, pressure gauges (measuring in maximum five pound per square inch (psi) increments), pumps and apparatus for testing. Gauges are subject to inspection and verification of accuracy on a dead weight tester. Contractor shall present documentation that the pressure gauges used for the test have been calibrated within six months prior to the test by an authorized testing facility. Prior to

pressure testing, all joint restraint shall be installed. The newly laid pipe, or any valved section thereof, shall be slowly filled with water from an approved source and all air expelled from the pipe at air release assemblies before applying the specified test pressure. The pressure test shall be of two hours minimum duration at a hydrostatic test pressure of 125 psi or 1.5 times the design operating pressure, whichever is greatest. The Contractor shall ensure that all intermediate valves remain open during the test. The piping section shall be deemed as passing the test if there is zero pressure drop during the two hour test period. At the completion of the test, the pressure shall be bled to zero and test gauge verified as registering zero. Any cracked or defective pipe, fitting or valve discovered in consequence of testing shall be removed and replaced by the Contractor with sound material in the manner specified. The test shall be repeated until a satisfactory rating is obtained.

G. Manhole - Installation:

Precast Concrete Manholes - The combined height of the manhole including base, barrel, cone, and casting should be constructed to provide the fewest number of joints. Apply a non-shrink grout inside and outside of all manhole joints. In adjustment of the manhole rim elevations, a maximum of up to 12 inches of adjustment rings may be used. A one foot barrel riser section must be used in adjustments of 12 inches or greater. The use of brick and mortar for making height adjustments is not permitted. Top sections shall be precast eccentric cones designed to receive the cast iron frame and cover.

Manhole Frame and Cover - The rim elevations should be a minimum of 18 inches above the ground in unimproved areas and where specified. The frame shall be securely bonded to the cone top or to the adjustment rings with adequate quantities of the sand-cement grout.

Manhole Steps - Manhole steps shall be cast integrally with precast concrete manholes and shall be constructed into and securely anchored to the walls of cast-in-place manholes. Steps shall be uniformly spaced at 12 to 16 inches on center vertically and shall project evenly unless otherwise approved.

Pipe Connections - Installation shall be per manufacturer's instructions and recommendations. Corings for boot connectors shall not be within four inches of the manhole barrel section joint. Manholes with multiple lateral boot installations shall be staggered as shown on the Standard Details located in the appendix.

Manhole Inverts - The inverts of manhole channels shall be smooth flow transitions using accurately shaped arcs connecting the inlets and outlet pipes in such a manner as to diminish any loss of head due to a change in the direction of flow. Bench slopes shall be a minimum of three inches vertical per foot of horizontal distance. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer and entering branch or branches shall have a true curve of as large a radius as the size of the manhole will permit.

Manhole Types - Manholes shall be one of the following types and shall be constructed in accordance with the Standard Details (located in the appendix) and these technical specifications:

1. A shallow manhole shall only be constructed at locations where the vertical depth between the invert of the midpoint of flow line and the top of the manhole rim does not exceed four feet. A case-by-case approval by the Engineer is required for shallow manholes.
2. A standard manhole shall be used for all locations unless the use of a shallow or drop manhole is required.
3. An Exterior Drop Manhole shall be constructed only when connecting a new line to an existing 48 inch diameter manhole. For all new construction and for existing 60 inch diameter manholes, Interior Drop Manholes shall be used when a drop is required. Drop type manholes are required if the vertical difference in depth between the midpoint of flow line and the invert of any inlet pipe is 24 inches or greater. Drop piping and fittings shall be Class 52 Ductile Iron and shall be encased in "diggable" flowable fill. A case-by-case approval by the Engineer is required for exterior drop manholes.
4. An Inside Drop Manhole shall be used for all new construction when a drop is required. Drop type manholes are required if the vertical difference in depth between the midpoint of flow line and the invert of any inlet pipe is 24 inches or greater. The minimum interior dimension of the manhole shall be 60 inches. Only one inside drop may be installed into a manhole unless specifically approved otherwise by the Engineer.
5. A Straddle Manhole shall only be used when approved by the Engineer for tying into an existing line.

H. Testing - Manhole:

All manholes shall be Vacuum tested by the Contractor in the presence of the Engineer or his authorized representative in accordance with the following procedure. The Contractor may elect to make a test for his own purposes prior to backfilling; however the manhole must be completely backfilled prior to acceptance testing. The manhole frame shall be installed and the joint between the manhole and the frame shall be included as part of the test. Prior to testing, thoroughly clean the manhole and seal all openings. Inflate the compression band to effect a seal between the vacuum base and the structure. Connect the vacuum pump to the outlet port with the valve open. Draw a vacuum of ten inches of mercury and close the valve. The required duration of the test is based upon the diameter of the manhole and is found in Table 3.4 below.

TABLE 3.4

VACUUM TEST TABLE	
Manhole Diameter (Inches)	Test Period (Seconds)
48	60
60	75
72	90

Record the vacuum drop during the test period. If the vacuum drop is greater than one inch of mercury during the test period, the manhole shall be repaired and retested. A vacuum drop of one inch or less of mercury during the test period, is an acceptable test result.

I. Pipe Installation - Casing Pipe:

The minimum cover for a bore and jack casing shall be 36 inches. The depth of cover must conform to that stated in Highway or Railway permits.

The casing excavation should not be more than one inch greater than the casing's outside diameter. Should the casing excavation be more than one inch larger than the outside diameter of the casing pipe, the void area shall be pressure grouted at the Contractor's expense.

The Contractor shall maintain the boring auger just far enough ahead of the casing being jacked to provide clearance for proper installation. Provide a continuous operation until the casing is installed. The bore equipment shall be of adequate size and capacity to perform the work.

The elevation of a finished casing must conform to the approved plans.

Welding shall be a full penetration circumferential weld performed by a qualified welder.

The Jack Pit and Receiving Pit shall be excavated in the location shown on the approved plans and be performed with a minimum of interference with, interruption or damage to the adjacent areas. The Jack Pit shall be kept in a dewatered state throughout the duration of operation. When the work is completed the pits shall be closed by proper backfilling and the disturbed areas restored to original or better condition.

The Contractor shall install sheeting, shoring and bracing as required to insure work area safety at all times.

Casing pipe size shall be as specified in Section II and shall be in accordance with the Standard Details found in the appendix.

J. Pump Stations:

Detailed plans and specifications of sewage pumping stations shall be reviewed and approved in writing by the York County Department of Environmental and Development Services prior to the start of construction. In addition, changes to any previously approved plans and specifications shall be approved in writing by the County prior to initiating the work.

Sewage pumping stations shall be constructed under the supervision of the design engineer who prepared the plans and specifications. All structural, electrical, mechanical and other work shall be conducted in strict accordance with all applicable codes, laws and regulations.

A minimum of Two weeks prior to final inspection of the pump station, three copies of the Operation and Maintenance manual shall be submitted to the County. The format and content shall be as required in Section IV of this document.

Upon completion of construction, the County will inspect the sewage pumping station. A test run shall demonstrate that the performance requirements of all pump station components have been met by the equipment as installed and shall include, but not be limited to, the following tests:

1. That all units have been properly installed.
2. That the units operate without overheating or overloading any parts and without objectionable vibration.
3. That there are no mechanical defects in any of the parts.
4. That the pumps can deliver the specified pressure and quantity.
5. That the pumps are capable of pumping the specified material.
6. That the pump controls perform satisfactorily.
7. That the generator and transfer switch operate automatically in a satisfactory manner.
8. That the alarm system operates satisfactorily.

The design engineer shall certify to the County and State Department of Health that the project has been completed in accordance with approved plans and specifications and in accordance with Section 2.05 of the Commonwealth of Virginia Sewerage Regulations. The design engineer shall develop and certify a set of as-built drawings for the station and the associated piping. These drawings shall be submitted to and approved by the

County as part of the acceptance process for the station. The County reserves the right to reject any station in the event that construction was not in accordance with the approved plans and specifications.

A guarantee of materials, equipment and workmanship for a period of one year from the date of acceptance by the County Administrator will be required from the Contractor and/or developer for stations to be owned by, or dedicated to, the County. The developer must submit a warranty bond with the guarantee in an amount equal to five percent of the construction cost of the pump station.

K. Private Sewerage Disposal and Grinder Pump Systems:

Low pressure sewer lines, as part of a private sewerage or grinder pump system, and which is being accepted by the County for maintenance shall be tested by the Contractor between the point of connection and the cleanout valve box. This test shall be witnessed by York County inspectors. Pressure and leakage tests for force mains that are to be dedicated to York County shall be performed in accordance with Section III of this specification.

Low pressure sewer lines shall be installed with a minimum depth of three feet. All materials and work shall be in accordance with manufacturer's instructions and recommendations.

A continuous plastic warning identification tape shall be installed within 18 inches of the ground surface. In addition, all non-metallic pressurized underground sewer lines shall have a plastic coated ten gauge copper clad wire running the entire length of the pipe. The wire shall be attached with plastic strapping or duct tape to the line at a maximum of ten foot intervals. The wire shall terminate inside the cleanout valve box or valve boxes used to house the wire ends at intervals that do not exceed 500 feet.

Proper thrust restraint shall be used. At a minimum thrust blocks shall be required at all vertical and horizontal bends greater than 11 degrees. The thrust blocks shall be placed against undisturbed earth and shall have a minimum bearing area of one square foot. When mechanical joints, fittings, valves, etc. are installed, plastic sheeting material shall be placed around the pipe and fitting joints before the concrete is poured to prevent bonding between the pipe and the concrete.

L. Vacuum Sewerage Collection Systems:

Detailed plans and specifications of Vacuum Sewerage collection systems shall be prepared by the Contractor's/Developer's design engineer. These plans shall be made in accordance with AIRVAC's design manual and shall be approved by both AIRVAC and the County. All construction shall be in accordance with the approved plans and specifications.

The AIRVAC valves are shipped to site fully assembled and ready to install in the valve pit. AIRVAC valves shall not be installed until the total sewerage system including the vacuum station is completed, vacuum tested, and put into operation and the gravity line from the home to the vacuum valve pit sump has been installed and inspected by the system operator or local plumbing inspector.

The recommended AIRVAC valve installation procedure is for the contractor to install the valve pits and all stub outs to cleanout assemblies. The AIRVAC valves are delivered to the system owner whose operators install the valves at the time the gravity lateral is inspected and approved.

Testing of Vacuum Sewage Collection Systems shall be in accordance with the AIRVAC Design Manual. Testing of the Collection system shall also be in accordance with the following.

At the end of each day's work, the mains and crossovers laid that day shall be subjected to a vacuum of 24 inches of mercury, allowed to stabilize for 15 minutes, and then shall not lose more than one percent vacuum pressure per hour for a two hour test period. As pipe is laid, the new section shall be tested in addition to the previously laid pipe on that main until a division valve is placed. Testing then shall be done with the valve either opened or closed as directed by the Engineer. If any section of the sewer fails the test, it shall be reworked prior to laying new sections of sewer.

Perform required final acceptances testing on complete system as follows -
Test the entire sewerage system to a vacuum of 24 inches mercury, allow to stabilize for 15 minutes. The test shall be initiated at 24 inches mercury. There shall be no loss greater than one percent per hour over a four hour test period. Contractor to provide 48 hours notice to Engineer prior to test. All division valves are to be opened prior to beginning of final acceptance test. Final acceptance test shall be recorded on approved vacuum chart recorder. This chart will not be considered valid unless witnessed by Engineer on the test equipment at beginning and the end of vacuum test period. Engineer will sign and date chart to verify witness of test. This signature does not indicate acceptance of the system.

After final acceptance testing, flush lines utilizing a double volume flush to remove debris and foreign materials that accumulated in the lines and valve pits during construction. At least 30 days prior to initiation of flushing operations, the Contractor shall submit his proposed plan for conducting line flushing to the Engineer for approval. The plan shall include the equipment to be used; the segments of the system to be flushed at a given time; the calculated volume of pipe (excluding three inch lines) to be flushed, by segment; the location of vacuum valves to be installed to facilitate the flushing operations; and the approximate volume of water to be introduced into the system at the end of each branch line, by segment.

The Contractor shall provide appropriate vacuum equipment and receiving tank to

accomplish the work. A vacuum pump may be temporarily connected to a collection tank to create a vacuum on the system of 20 inches of mercury. The Contractor shall supply all water necessary to achieve an acceptable flush of the system.

The following describes the flushing procedure:

Place system under vacuum at the downstream end of the vacuum main segment being flushed. Add water to valve pits at extreme ends of system and cause vacuum valves to operate. (Contractor to supply and install valves at the terminal end of each branch line to facilitate flushing.) Utilize system vacuum to transport water and debris to collection point. Adjust valve timer to allow sufficient air into the system (approximately 7:1 air to liquid ratio). Continue procedure until water entering at collection point is free of contamination or debris. Contractor shall legally dispose of flushing water and debris. Contractor shall remove valves and reinstall temporary caps. After flushing is complete, Contractor shall evacuate all flush water from the system and leave the completed system under 20 inches of vacuum.

SECTION IV SUBMITTALS

A. General Requirements

Detailed utility design calculations, plans and specifications are to be submitted to York County through the Department of Environmental and Development Services (in accordance with §24-212 of the York County Zoning Ordinance). The costs for review of designs, calculations, plans and specifications shall be as stipulated in the York County Code.

Changes to any previously approved plan or specification shall require prior approval by the County and state agencies affected by those changes. Adequate copies of the plans showing proposed changes shall be submitted.

Utility plans shall contain a title sheet showing a vicinity map and an index of the construction sheets. An overview map (scale 1 inch = 200 feet) shall be provided that includes the system being constructed, street layout and names, pipe size, manhole numbers, flow direction, drainage facilities, water lines and fire hydrants. The title sheet submitted with the as-builts shall be updated upon completion of subsequent phases to adequately portray the existing system. Plan sheets shall be twenty-four inches high by thirty-six inches long. Margins shall be one-half (1/2) inch top and bottom, three-quarter (3/4) inch on the right side and one and three-quarter (1-3/4) inch on the left side. A standard title block shall be located in the lower right hand corner of each sheet. All other requirements of §24-208 or §24-209 of the York County Zoning Ordinance for preparation and submission of development plans shall be met.

The County Administrator will authorize acceptance of the sewer system for operation and maintenance after all submittal requirements of the County have been met.

B. Sewer Systems

1. The minimum horizontal scale for sewer line plans shall be no less than one inch equals fifty feet (1 inch = 50 feet). Scale factors less than the minimum may be approved by the Director for projects that require greater detail. The vertical scale shall be proportional to the horizontal scale. Single or double cycle plan profile sheets may be used. The location of the sewer shall be shown on the upper half of the drawing with the sewer profile and ground elevation shown on the lower half of the plan.
2. For gravity sanitary sewer systems, types of material, slope, rim and invert elevations, and centerline station shall be shown in plan and profile views. All manholes shall be numbered and located by station with manhole inverts and rim elevations on both plan and profile. Laterals shall be provided to all lots.

3. For water systems and sanitary force mains, all horizontal bends, vertical offsets, valve, hydrants, ends of all lines, and other fittings shall be accurately indicated in the plan and profile view.
4. The plans shall show the location of all road rights-of-way, York County easements (existing and proposed), property boundaries, houses or other structures. New developments shall show all proposed utility placement so as to show the effect, if any, upon utilities and easements that are to be dedicated to York County. Designs shall endeavor to keep other public utilities out of County easements.

C. Pump Stations

Sewage pump stations that are constructed within York County shall have the station plans and specifications reviewed and approved prior to construction. Two (2) complete sets of plans and specifications shall be submitted to the County for review. These documents shall also be reviewed by the State Health Department for compliance with State regulations and shall be approved prior to acceptance by York County.

1. Plans - Pump station plan sets shall contain the following:
 - a. Title sheet: All pump station plan sets shall contain a title sheet with the following
 - () Project name or designation
 - () Sheet index
 - () Project vicinity map
 - () Project service area
 - () Project owner
 - () Professional engineering seal
 - b. Site plan: All pump station plan sets shall contain a site plan with the following:
 - () North arrow
 - () Bench mark
 - () Locations of existing utilities
 - () Locations of all easements
 - () Scale identified
 - () Erosion control measures
 - () Existing and final topography
 - () Pump station landscaping
 - () Pump station fence location
 - () Site drainage

() 100 year flood elevation, if applicable

- c. Construction plans and details shall be clearly and neatly drawn with proper identification, dimensions, material and other information necessary to insure the desired construction.
2. Specifications shall typically be of the Construction Specification Institute (CSI) format and contain technical data on the following:
- a. Projected flow rate/existing and future head conditions.
 - b. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on eight and one-half (8½) inch by eleven (11) inch sheets, at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to maximum manufacturer recommended pump capacity. Catalog sheets showing a family of curves will not be acceptable.
 - c. Other pertinent engineering data
3. Operation and Maintenance Manuals:
- a. The contractor shall furnish four copies of a loose-leaf type manual that contains complete operation and maintenance instructions for the following equipment:
 - 1. Control System
 - 2. Air Compressor
 - 3. Sewage Pumps, Including Pump Curves
 - 4. Electric Motors
 - 5. Generator Set, Including Transfer Switch Wiring Diagrams
 - 6. Alarm Systems
 - 7. Check Valves
 - 8. Gate Valves
 - 9. Unit Heaters
 - 10. Lights
 - b. The manual shall include model numbers, a complete parts list and the names and addresses of applicable subcontractors, suppliers, and manufacturers.
 - c. A Schedule of Values of major pump station items as shown in Appendix E.

- d. The manual shall contain adequate information to satisfy State regulatory agency requirements.

D. As-Built Drawings

1. **PRIOR TO THE INSPECTION** of sewer, water, or drainage improvements by York County, the engineer or surveyor shall submit four (4) **preliminary paper copies** of as-builts for the respective project to the Department of Environmental and Development Services. The Department will distribute the as-builts to the appropriate organizations in the in the County and coordinate the review and approval of the respective as-builts. Copies should be submitted as soon as possible to facilitate a prompt acceptance process. The developer will be allowed no more than five (5) connections to the newly installed utility prior to the submittal of **final** as-built drawings and acceptance by the County. The remaining connections will be allowed only after the developer has completed item D.2 below. If there are ten (10) or less connections resulting from the new development, the developer shall complete item D.2 below before any connection will be permitted.
2. Upon approval of the preliminary as-builts, the developer shall:
 - a) Submit a letter requesting the County Administrator to accept the project. The letter shall include the costs associated with installing the sanitary sewer, both on-site and off-site if necessary. A one (1) year letter of warranty shall accompany the letter.
 - b) Through his engineer or surveyor, submit one (1) reproducible mylar drawing and six (6) complete sets of prints for the entire project.
3. The following requirements are necessary for Sanitary Sewer and Pump/Lift Station as-builts:
 - a) The name of the development.
 - b) The size of the as-built sheet shall be 24 inch x 36 inch and shall have a thickness of 0.003 mil (final reproducible). The original construction plan drawings may be modified in that design parameters can be erased and "as-built" information incorporated.
 - c) A certification statement shall be included on the as-built as follows:

"The sanitary sewer, water, and drainage structure locations and grades shown on these drawings, are accurate and complete to the best of my

knowledge and belief and I certify that I, or my agent, have made sufficient inspection to ensure the accuracy of this statement."

Signature of person cited in (d)

- d) The name of the engineer or surveyor along with his or her seal (York County will only accept flow calculations from surveyors with parts A & B licenses).
 - e) Show lot numbers, property lines and addresses (if available).
 - f) Show drainage and utility easements with the deed book and page of recordation. (on-site and off-site if necessary).
 - g) Indicate bench mark(s) used and the description.
4. In addition to the requirements outlined in Section 3 above, the following information is necessary for Sanitary Sewer as-builts:
- a) The rim and invert elevations of manholes.
 - b) The length, type, size, and slope (gravity sewer) of sewer lines are required. Note: If the slope is less than the minimum required by York County Specifications or the Virginia Department of Health Sewerage Regulation No. 21.05.03, then a flow certification by the engineer or surveyor will be required and drafted on the as-builts.
 - c) Manholes shall be numbered and measurements given between manholes using continuous stationing running from downstream to upstream. All measurements shall be taken from the center of the manhole cover.
 - d) Except in a cul-de-sac, lateral clean-outs/water meter locations shall be measured using continuous stations and off-set from the center line of the main line sewer or water main. Sewer lateral clean-outs located out of end manholes or water meters in cul-de-sacs shall use continuous stationing along the end main line alignment providing an offset distance from this stationing and the actual lateral length. The following information shall be provided for each sanitary sewer or water service line:
 - i) Run Up (RU) = The horizontal measurement of the actual lateral pipe (right or left).
 - ii) Height (Ht) = The distance measurement at 90 degrees offset from the main line to the end of the actual lateral pipe.

- iii) Depth (D) = The depth of the lateral at the property line (Note: Normally between 36" and 60").
 - iv) Wye = The station location of the wye (actual location using continuous stationing).
 - v) Corp. = The station location of the corporation stop (for water mains).
 - e) All horizontal bends, vertical offsets, valves, hydrants, ends of all lines, and other fittings shall be accurately located on the as-built by triangulation from two permanent structures, which will be visible on the ground surface.
 - f) Show significant physical conflicts with the mainline, in relation to other utilities.
 - g) Identify and label all existing sewers or water mains affecting respective project.
5. In addition to the requirements outlined in Section 3 above, the following information is necessary for Pump/Lift Station as-builts:
- a) Number of homes to be served and total number of homes capable of being served.
 - b) Internal piping and mechanical layout with sizes, material, and measurements from the structure.
 - c) Architectural drawing of the structure showing sizes and materials.
 - d) Dimensioned site plan showing easements, deed/plat book and page number of recordation, station external piping, driveway, landscaping and drainage as situated on the plans.
 - e) All pump criteria as to present an ultimate capacity, head conditions, RPM's, impeller size, pump type and motor size.
6. An "as-built" checklist is provided in Appendix D.
7. Construction record information shall conform to the tolerances listed in the table below:

INFORMATION ACCURACY			
	SURVEY	CONSTRUCTION	CONSTRUCTION

			TOLLERANCE
Manhole Rim & Invert	X		± .05 ft.
Manhole Location	X		± 1.0 ft.
Fire Hydrant Location	X		± 1.0 ft.
Valve Location	X		± 1.0 ft.
Fitting Location		X	± 1.0 ft.
Offset Location		X	± 3.0 ft.
Lateral Location		X	± 1.0 ft.
Corp. Stop Location		X	± 1.0 ft.
Meter Location	X		± 1.0 ft.
Blowoff, Air Vent Location	X		± 1.0 ft.
Pressure Pipe Location		X	± 1.0 ft.
Pressure Pipe Depth		X	± 6.0 in.
Pump Station Elevations	X		± .05 ft.
Pump Station Other		X	± 1.0 in.

E. Guarantee and Warranty

The developer shall submit a letter requesting the County Administrator to accept the public facilities for use by the County. Accompanying this letter shall be a final quantity take-off and a one-year letter of warranty containing the following verbiage:

On _____, 19____, we submitted to you the manufacturer's warranties relative to _____ (project). This firm hereby agrees to be responsible for performance in connection with all of the guarantees provided under these warranties. Additionally, this firm hereby warrants, for the period of one (1) year after acceptance of the project, all materials, equipment, and workmanship associated with the project. Additionally, this firm does hereby agree to conform in all respects to the requirements of Chapter 18.1 of the York County Code.

Sewer systems to be owned by, or which will be dedicated to, the County shall be guaranteed by the developer or contractor for a period of one (1) year after the date of formal acceptance by the County Administrator. The guarantee shall cover all materials, equipment and workmanship and shall commence on the date that the facilities are accepted by the County Administrator.

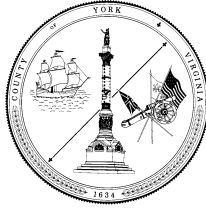
Should any item of equipment malfunction within the year of guarantee, the developer or contractor shall, at his own expense, renew or replace it, or do whatever is necessary to remedy the fault. The developer or contractor shall, during the same one year period, repair promptly at this own expense all breaks or failures due to faulty material or workmanship.

In addition to the above stated one (1) year guarantee, the developer or contractor shall, for all equipment installed for which the manufacturer thereof has a standard guarantee in

excess of one year, furnish to the County all the necessary warranties to properly guarantee such equipment by the manufacturer for the standard term of the manufacturer's guarantee.

The above warranty shall be secured by a letter of credit in an amount determined acceptable to cover uncompleted construction work or a minimum of five (5) percent of the cost of actual construction, whichever amount being greater. This may be included in other development guarantees.

COUNTY OF YORK, VIRGINIA



CERTIFICATE TO CONSTRUCT SEWER FACILITIES

_____ is hereby granted a Certificate to Construct Sewer Facilities in accordance with Section 18.1-52 of the York County Code, as amended by the County Board of Supervisors. Sewer construction is to be in accordance with the provisions of Chapter 18.1, Sewage Disposal and Sewers, York County Code, the Commonwealth of Virginia Sewage Regulations, the Occupational Safety and Health Standards, and the York County Sewer Regulations.

This certificate is valid from the date of issue for a period not to exceed one (1) year and is subject to revocation for non-compliance with the above requirements. Any changes in these approved plans require notification to, and approval by, the Division of Utilities, Department of Environmental and Development Services.

A pre-construction meeting is required before any sewer work is started. The required pre-construction meeting must be conducted at least two (2) weeks (14 days) lead time prior to the ordering of materials. Additionally, the contractor must notify the Project Manager (890-3752) a minimum of 48 hours prior to beginning any sewer facilities construction or testing to ensure that an inspector will be available.

LOCATION AND DESCRIPTION

Plan approved on: _____

Name of Contractor: _____

Plan dated: _____

Amount of fee: _____

Plan prepared by: _____

Fee paid on: _____

APPROVED: _____

APPROVED: _____

Infrastructure Services Branch Manager

Chief of Utilities

Certificate No. _____

Date: _____

Copy to: Department of Financial & Management Services
 Division of Building Regulation
 Project Manager
 File

Revised 12/99

